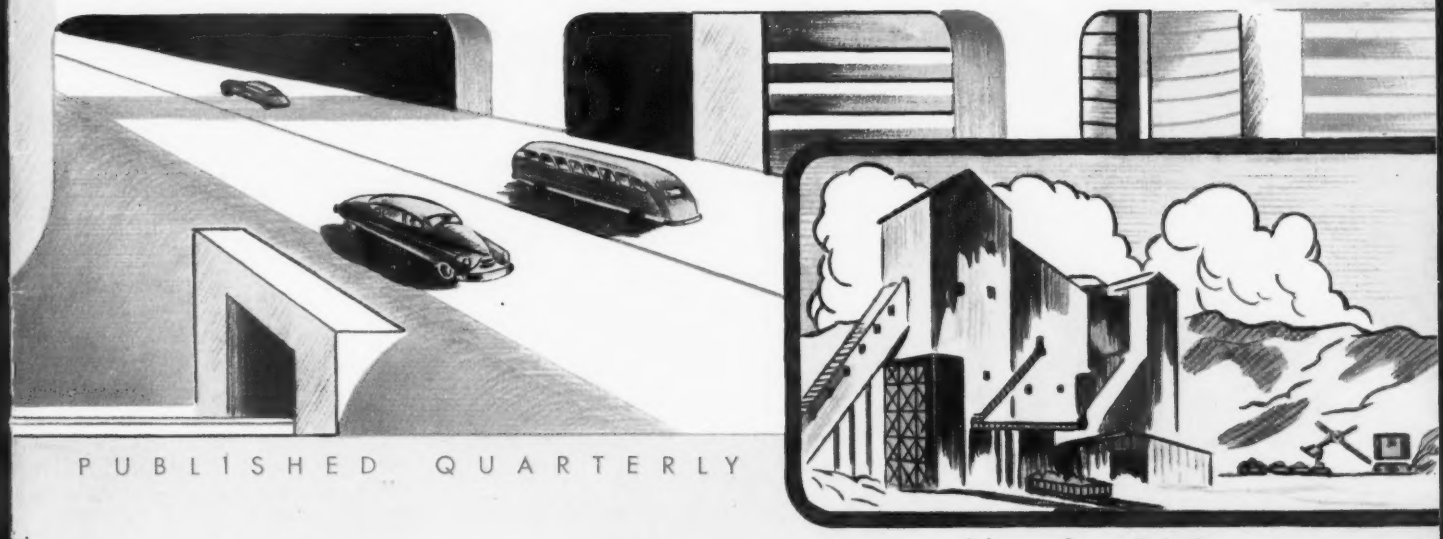
The CRUSHED STONE JOURNAL



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In This Issue

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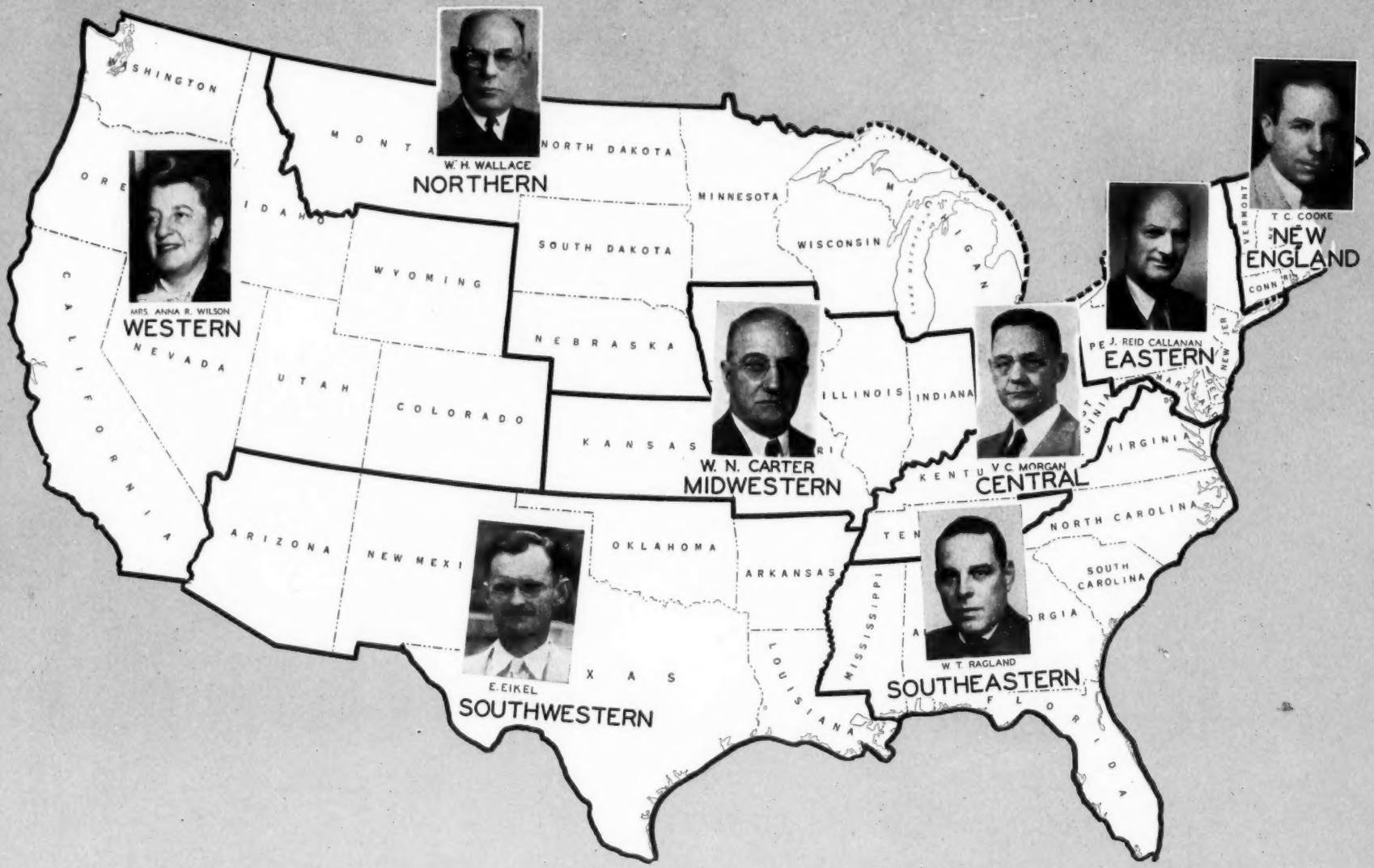
OFFICIAL PUBLICATION · NATIONAL CRUSHED STONE ASSOCIATION

MAP SHOWING REGIONS AND REGIONAL VICE PRESIDENTS FOR 1949
NATIONAL CRUSHED STONE ASSOCIATION



The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

Contents

W. S. WESTON, JR.

President
Weston and Brooker Co.
Columbia, S. C.

●

Re-elected President
NATIONAL CRUSHED STONE ASSOCIATION
at its 32nd Annual Convention
New York, N. Y.
February 7-9, 1949

H. C. KRAUSE

President
Columbia Quarry Co.
St. Louis, Mo.

●

Re-elected President
AGRICULTURAL LIMESTONE INSTITUTE
at its 4th Annual Convention
Chicago, Ill.
February 21-22, 1949

THE CRUSHED STONE JOURNAL

WASHINGTON, D. C.

Vol. XXIV No. 1 PUBLISHED QUARTERLY MARCH, 1949

32nd Annual Convention of NCSA Surpasses Expectations

DELEGATES to the 32nd Annual Convention of the National Crushed Stone Association held in the Hotel New Yorker, New York City, on February 7, 8, and 9, 1949, convincingly indicated throughout the convention period their enthusiastic and wholehearted approval of the exceptionally fine program which had been developed under the capable direction of the Convention Arrangements Committee. Customarily, a convention program is considered to have "highlights," but as the 32nd Annual Convention went into full swing it soon became obvious that never before in the history of the organization had such a talented array of speakers been brought together in one program. Variety, it is said, is the spice of life and it certainly adds much to the enjoyment of a convention. It was present in goodly measure at the New York meeting. Well qualified experts gave informative talks concerning important industry problems; there were those whose purpose was to give a better perspective of world events and their relationship to the affairs of the United States; and in addition, the lighter side was effectively handled by talks in humorous veins and the many highly enjoyable social events held throughout the meeting.

The attendance exceeded expectations with over seven hundred officially registered, a surprisingly large figure considering that there was no exposition, that the Agricultural Limestone Institute met separately in Chicago two weeks later, and that the convention was located on the eastern seaboard.

With between eighty and ninety ladies present in New York, it is clearly evident, and pleasingly so, that convention attendance is becoming more and more appealing to the fairer sex. An unusual program of entertainment was offered for their enjoyment and included a specially arranged tour of United Nations and a number of feature broadcasts. In addition, many took advantage of the opportunity offered by New York to see a number of the latest shows.

It is no exaggeration to say that those who were unable to attend the 32nd Annual Convention missed a meeting of unusual interest and value and while it is not possible to give a detailed account in the limited space available, the following should prove of interest.

Election of Officers and Board of Directors

The election of officers and members of the Board of Directors took place at the annual business meeting of the Association held on Tuesday morning, February 8. Preliminary to submitting the report of the Nominating Committee, its Chairman, G. A. Austin, emphasized the fact that the sole responsibility of the Committee was to place before the membership candidates for the Board and for the various offices, who in its judgment seemed qualified to serve. He said it should be recognized that nominations from the floor were entirely in order and no one should hesitate to place in nomination the name of anyone who he felt might be better qualified than those suggested by the Committee. Chairman Austin pointed out that the By-Laws of the Association provide that there shall be a Board of Directors consisting of forty-eight members, that the President, eight Re-

H. C. KRAUSE
Columbia Quarry Co.
St. Louis, Mo.
President,
Agricultural Limestone Institute

W. S. WESTON, JR.,
Weston & Brooker Co.
Columbia, S. C.
President,
National Crushed Stone Association

COTTRELL FARRELL
Easton Car & Construction Co.
Easton, Pa.
Chairman,
Manufacturers Division

EXECUTIVE COMMITTEE

of the

NATIONAL CRUSHED STONE ASSOCIATION

for the year 1949

G. A. AUSTIN
Consolidated Quarries Corp.
Decatur, Ga.

W. N. CARTER
National Stone Co.
Joliet, Ill.

OTHO M. GRAVES
General Crushed Stone Co., Easton, Pa.

RUSSELL RAREY
Marble Cliff Quarries Co., Columbus, Ohio

F. W. SCHMIDT, JR.
North Jersey Quarry Co., Morristown, N. J.

W. F. WISE
Southwest Stone Co.,
Dallas, Texas

A. L. WORTHEN
New Haven Trap Rock Co., New Haven, Conn.

NEWLY ELECTED MEMBERS OF THE BOARD

C. P. HAUN
Franklin Limestone Co.
Nashville, Tenn.

A. W. MCTHENIA
Acme Limestone Co.
Fort Spring, W. Va.

JOHN H. ODENBACH
Dolomite Products Co., Inc.
Rochester, N. Y.

F. B. THACHER
Carbon Limestone Co.
Youngstown, Ohio

New Honorary Members

F. O. EARNSHAW
Hillsville, Pa.

J. A. RIGG
Fort Spring, W. Va.

gional Vice Presidents, the Chairman and two representatives of the Manufacturers Division, and the President and two representatives of the Agricultural Limestone Institute shall be ex officio members of the Board, leaving not more than thirty-three additional members to be elected by the membership.

Chairman Austin then submitted his report in detail which resulted in the unanimous election of members of the Board as listed below, of whom Messrs. Haun, McThenia, Odenbach and Thacher serve on the Board for the first time.

Elected Directors

G. A. Austin, Consolidated Quarries Corp., Decatur, Ga.
L. J. Boxley, Blue Ridge Stone Corp., Roanoke, Va.
H. H. Brandon, Melvin Stone Co., Melvin, Ohio.
Bruce S. Campbell, H. T. Campbell Sons' Corp., Towson, Md.
A. J. Cayia, Inland Lime and Stone Co., Manistique, Mich.
Arthur F. Eggleston, John S. Lane & Son, Inc., Meriden, Conn.
Wilson P. Foss, III, New York Trap Rock Corp., New York, N. Y.
Otho M. Graves, General Crushed Stone Co., Easton, Pa.
G. F. Hammerschmidt, Elmhurst-Chicago Stone Co., Elmhurst, Ill.
R. G. L. Harstone, Canada Crushed Stone Ltd., Hamilton, Ont., Canada.
C. P. Haun, Franklin Limestone Co., Nashville, Tenn.
J. L. Heimlich, LeRoy Lime and Crushed Stone Corp., LeRoy, N. Y.
R. P. Immel, American Limestone Co., Knoxville, Tenn.
N. E. Kelb, Cumberland Quarries, Inc., Indianapolis, Ind.
H. C. Krause, Columbia Quarry Co., St. Louis, Mo.
R. T. Lassiter, Southern Aggregates Corp., Raleigh, N. C.
J. B. Lauber, Trap Rock Co., Minneapolis, Minn.
G. D. Lott, Jr., Palmetto Quarries Co., Columbia, S. C.
M. E. McLean, East St. Louis Stone Co., East St. Louis, Ill.
A. W. McThenia, Acme Limestone Co., Fort Spring, W. Va.
Paul M. Nauman, Dubuque Stone Products Co., Dubuque, Iowa.
John H. Odenbach, Dolomite Products Co., Inc., Rochester, N. Y.
H. E. Rainer, Federal Crushed Stone Corp., Buffalo, N. Y.
Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio.
W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.
James Savage, Buffalo Crushed Stone Corp., Buffalo, N. Y.
F. W. Schmidt, Jr., North Jersey Quarry Co., Morristown, N. J.
A. T. Smith, Rock Hill Quarries Co., St. Louis, Mo.
O. M. Stull, Liberty Limestone Corp., Buchanan, Va.
F. B. Thacher, Carbon Limestone Co., Youngstown, Ohio.
D. L. Williams, Virginian Limestone Corp., Ripplemead, Va.
W. F. Wise, Southwest Stone Co., Dallas, Texas.
A. L. Worthen, New Haven Trap Rock Co., New Haven, Conn.

Regional Vice Presidents

In accord with the recommendations of the Nominating Committee, the following were unanimously elected as Regional Vice Presidents for the regions indicated:

Eastern—J. Reid Callanan, Callanan Road Improvement Co., South Bethlehem, N. Y.
New England—T. C. Cooke, Lynn Sand & Stone Co., Swampscott, Mass.
Midwestern—W. N. Carter, National Stone Co., Joliet, Ill.
Southeastern—W. T. Ragland, Superior Stone Co., Raleigh, N. C.
Central—V. C. Morgan, Kentucky Stone Co., Louisville, Ky.
Northern—W. H. Wallace, Wallace Stone Co., Bay Port, Mich.
Western—Mrs. Anna R. Wilson, Granite Rock Co., Watsonville, Calif.
Southwestern—E. Eikel, Servtex Materials Co., New Braunfels, Texas

COTTRELL FARRELL, *Chairman*
Easton Car and Construction Co.
Easton, Pa.

EXECUTIVE COMMITTEE

of the

MANUFACTURERS DIVISION

National Crushed Stone Association

for the year 1949

IRWIN F. DEISTER
Deister Machine Co.
Fort Wayne, Ind.

R. C. JOHNSON
Simplicity Engineering Co.
Durand, Mich.

J. CRAIG MCLANAHAN
McLanahan and Stone Corp.
Hollidaysburg, Pa.

J. B. TERBELL
American Manganese Steel Division
American Brake Shoe Co.
New York, N. Y.

W. S. WESTON, JR., *President, NCSA*
Weston and Brooker Co.
Columbia, S. C.

W. S. Weston, Jr., Re-Elected President

In concluding his report, Chairman Austin observed that the candidate for President selected by the Nominating Committee a year ago had proven to be congenial, courageous, and capable, and in recognition of valuable service effectively rendered, enthusiastically and unanimously placed in nomination the name of W. S. Weston, Jr. for President for the coming year. This announcement was greeted with applause, whereupon Steve Weston was unanimously re-elected President by acclamation. In accepting the office of President for a second term, Mr. Weston expressed his appreciation for the honor and stated he would continue to do his best to give his best.

JAMES SAVAGE
Buffalo Crushed Stone Corp., Buffalo, N. Y.
Re-elected Treasurer

Representatives of ALI and Manufacturers Division

At the annual business meeting of the Agricultural Limestone Institute held on February 22, 1949, H. C. Krause was re-elected President of the Institute and P. E. Heim and S. P. Moore were designated to serve with him on the NCSA Board.

At the annual business meeting of the Manufacturers Division held on February 8, 1949, Cottrell Farrell was re-elected Chairman of the Division and R. C. Johnson and J. B. Terbell were designated to serve with him on the NCSA Board.

Executive Committee and Staff Officers Elected

The newly elected Board of Directors met immediately following the conclusion of the convention session on Tuesday afternoon, February 8, 1949, and elected the following to the positions as indicated:

Executive Committee

Elected Members

G. A. Austin, Consolidated Quarries Corp., Decatur, Ga.
W. N. Carter, National Stone Co., Joliet, Ill.
Otho M. Graves, General Crushed Stone Co., Easton, Pa.
Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio
F. W. Schmidt, Jr., North Jersey Quarry Co., Morristown, N. J.
W. F. Wise, Southwest Stone Co., Dallas, Texas
A. L. Worthen, New Haven Trap Rock Co., New Haven, Conn.

Ex Officio Members

W. S. Weston, Jr., President of NCSA
H. C. Krause, President of ALI
Cottrell Farrell, Chairman of the Manufacturers Division

Officers

Treasurer—James Savage
Engineering Director—A. T. Goldbeck
Field Engineer—J. E. Gray
Administrative Director and Secretary—J. R. Boyd

Honorary Members of the Board

F. O. Earnshaw, Hillsville, Pa.
John C. Gall, Washington, D. C.
John Rice, Easton, Pa.
J. A. Rigg, Fort Spring, W. Va.
H. E. Rodes, Nashville, Tenn.
Stirling Tomkins, New York, N. Y.
Harold Williams, Boston, Mass.

Manufacturers Re-Elect Cottrell Farrell Chairman

Excellently attended with over a hundred representatives of member companies present, the Manufacturers Division held its annual business meeting at luncheon on Tuesday, February 8, 1949.

Cottrell Farrell, President of the Easton Car and Construction Co., Easton, Pa., was unanimously re-elected Chairman of the Division and in addition the following were elected to offices as indicated:

Vice Chairmen

Irwin F. Deister, Deister Machine Co., Fort Wayne, Ind.
R. C. Johnson, Simplicity Engineering Co., Durand, Mich.
J. Craig McLanahan, McLanahan & Stone Corp., Hollidaysburg, Pa.

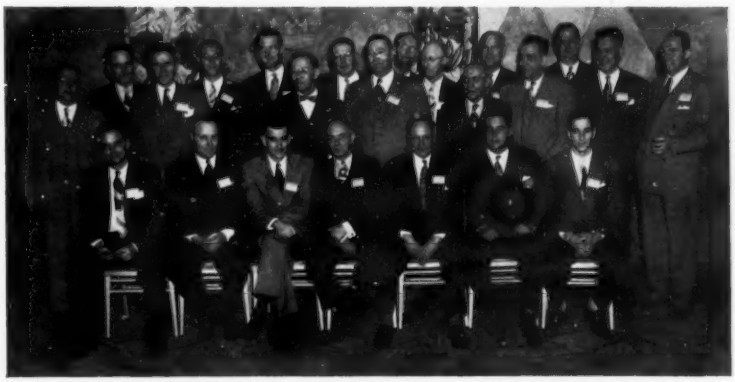
Elected Directors

E. C. Anderson, Kensington Steel Co., Chicago, Ill.
D. McM. Blackburn, Hendrick Mfg. Co., Carbondale, Pa.
A. E. Conover, Robins Conveyors Division, Hewitt-Robins, Inc., New York, N. Y.
L. A. Eiben, Northern Blower Co., Cleveland, Ohio
S. S. Ellsworth, Ensign-Bickford Co., Simsbury, Conn.
R. F. Feind, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
C. O. Friend, Nordberg Mfg. Co., Milwaukee, Wis.
J. Harper Fulkerson, Cross Engineering Co., Carbondale, Pa.
E. J. Goes, Koehring Co., Milwaukee, Wis.
E. M. Heuston, Bucyrus-Erie Co., South Milwaukee, Wis.
John M. Jeffries, Atlas Powder Co., Wilmington, Del.
R. D. Ketner, General Electric Co., Schenectady, N. Y.
W. W. King, W. S. Tyler Co., Cleveland, Ohio
Kenneth Lindsay, Iowa Mfg. Co., Cedar Rapids, Iowa
B. R. Maloney, E. I. du Pont de Nemours & Co., New York, N. Y.
M. L. McCormack, Ingersoll-Rand Co., New York, N. Y.
L. C. Mosley, Marion Power Shovel Co., Marion, Ohio
R. M. Murdock, Frog, Switch & Mfg. Co., New York, N. Y.
Milo A. Nice, Hercules Powder Co., Wilmington, Del.
F. O. Reedy, Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
J. Jess Richards, Jr., Link-Belt Co., Philadelphia, Pa.
C. H. Roberts, Traylor Eng. & Mfg. Co., Allentown, Pa.
W. A. Rundquist, Pioneer Engineering Works, Inc., Minneapolis, Minn.
J. B. Terbell, American Manganese Steel Division, American Brake Shoe Co., New York, N. Y.
J. A. Trainor, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

F. B. Ungar, Ludlow-Saylor Wire Co., St. Louis, Mo.
Roy Wills, Lima Shovel & Crane Division, Lima-Hamilton Corp., Lima, Ohio

Elected Representatives on NCSA Board

R. C. Johnson, Simplicity Engineering Co., Durand, Mich.
J. B. Terbell, American Manganese Steel Division, American Brake Shoe Co., New York, N. Y.



Members of the Manufacturers Division Board

Presentation of Safety Awards

Awards to the winners in the NCSA Safety Contest for 1947 were presented at the convention session on Monday afternoon. The presentation ceremony, recorded below, was handled by F. J. Buffington, Chairman of the Cement and Quarry Section of the National Safety Council and Safety Engineer for the New York Trap Rock Corporation of New York City.

"*Mr. Buffington:* At this time every year we take notice of the fact and also give credit where credit is due when a good job of safety work has been done. As you know, these awards come one year late, and in the year 1947, there were fifty plants which competed in the NCSA Safety Competition, consisting of forty-two quarries and eight mines, working a total of 8.25 million man-hours.

"I regret to report that the experience for the group as a whole in its competition was not good because there were ten fatal injuries and a total of 73,553 man-days lost. This is the worst year since 1930. Those ten fatal injuries are a very serious thing. I think that we should work particularly hard in the years to come to remove such fatalities.

"There was a total of 73,553 man-days lost. That means between one-half and three-quarters of a million dollars lost to the industry and lost to the men and families involved.

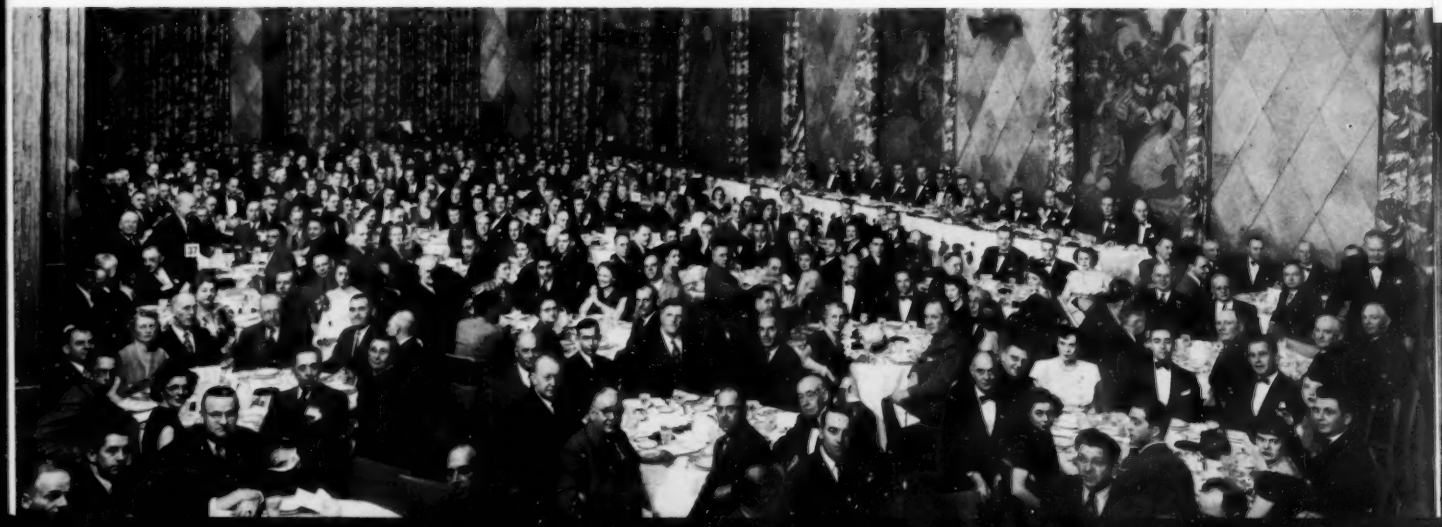
"The severity rate in 1947 was 8.90, two and a half times that in 1946, and eight times that in 1945, which was, by the way, our very best year. So, we haven't much as a group to pat ourselves on the back about, but there were, fortunately, a few bright spots in this 1947 picture, and the plants of the General Crushed Stone Company are the ones which have brightened the gloom the most. Their LeRoy Plant won the trophy in 1946, and in 1947 the Rock Hill Plant at Quakertown, Pennsylvania, won the contest with 93,869 man-hours without a lost-time accident.

"I should also point out at this time that there were no accidents involving lost time in this plant in 1929, 1931, 1939, and 1943. This, I think, is the kind of performance that we should all take our hats off to.

"I believe that E. Z. Cole, Superintendent of the Rock Hill Plant, is here today, and to whom I will hand this bronze plaque, which is *The Explosives Engineer* award given each year to the winning plant. I think you all should stand up and give a hand to this man as we give him this plaque.

"*Mr. Cole:* Thank you. All I can say is that it is only possible to accomplish these things if the execu-

32ND ANNUAL BANQUET OF NCSA



tives above you are interested and hand their experiences down to you. I thank you. (Applause)

"*Mr. Buffington:* I think what Mr. Cole has said is very pertinent to the theme at hand here, that unless management is heart and soul back of any safety program, no superintendent can possibly hope to achieve any great measure of success.

"I want you to note also that this year the General Crushed Stone Company had two other plants with outstanding records; in other words, they take the first three places in this safety competition for the year 1947. I understand that the superintendent of the Winchester, Massachusetts, plant, which worked 86,460 hours without a lost-time accident, is not here; and I understand that Lynn Crowell, the Superintendent of the Auburn Plant, which worked 64,576 hours without a lost-time accident, is not here, but H. F. Yotter of the General Crushed Stone Company, Easton, Pennsylvania is here, the man who is responsible for all the safety work in all the plants of the General Crushed Stone Company. I see Otho M. Graves, President of the General Crushed Stone Company is also with us. Mr. Graves, how many plants do you have?

"*Mr. Graves:* Twenty-six.

"*Mr. Buffington:* It is twenty-six plants, Mr. Graves tells me, and Mr. Yotter is responsible for safety in all of those plants. Mr. Yotter, will you please come forward and take these certificates?

"*Mr. Yotter:* I do not want to say anything except to wish you all the same luck we have had in the last few years. I do not know what the result was for last year, as it has not been announced, but we had three quarries again in 1948 that had no lost-time accidents, and each of these quarries put in more man-hours than the plants that won these awards in 1947. So, I wish you all the best of luck in your endeavors.

"*Mr. Buffington:* I should add right now that, while I have not checked these figures, I think they are correct, and I have heard that since 1926 when the White Haven Plant of the General Crushed Stone Company went through a year without a lost-time accident, they have had at least one plant among the winners each year. That, I think, is another outstanding tribute to the management and the men. Mr. Graves, I think you should stand up right here and take a little bow, because I know you are responsible for a lot of it.

"*Mr. Graves:* Thank you, Mr. Buffington.

"*Mr. Buffington:* I should point out, though, that these three plants ran up a total of 245,000 hours in 1947 without a lost-time accident.

"There are two other plants which won certificates of award, and they are the Marquette Quarry of the Marquette Cement Manufacturing Company, at Cape Girardeau, Missouri, working 63,622 man-hours without a lost-time accident; and No. 4 Trap Rock Quarry, Southwest Stone Company, of Uvalde County, Texas, that worked 55,515 man-hours. (W. F. Wise received the award for the Southwest Stone Company; there was no one present from the Marquette Cement Manufacturing Company.)

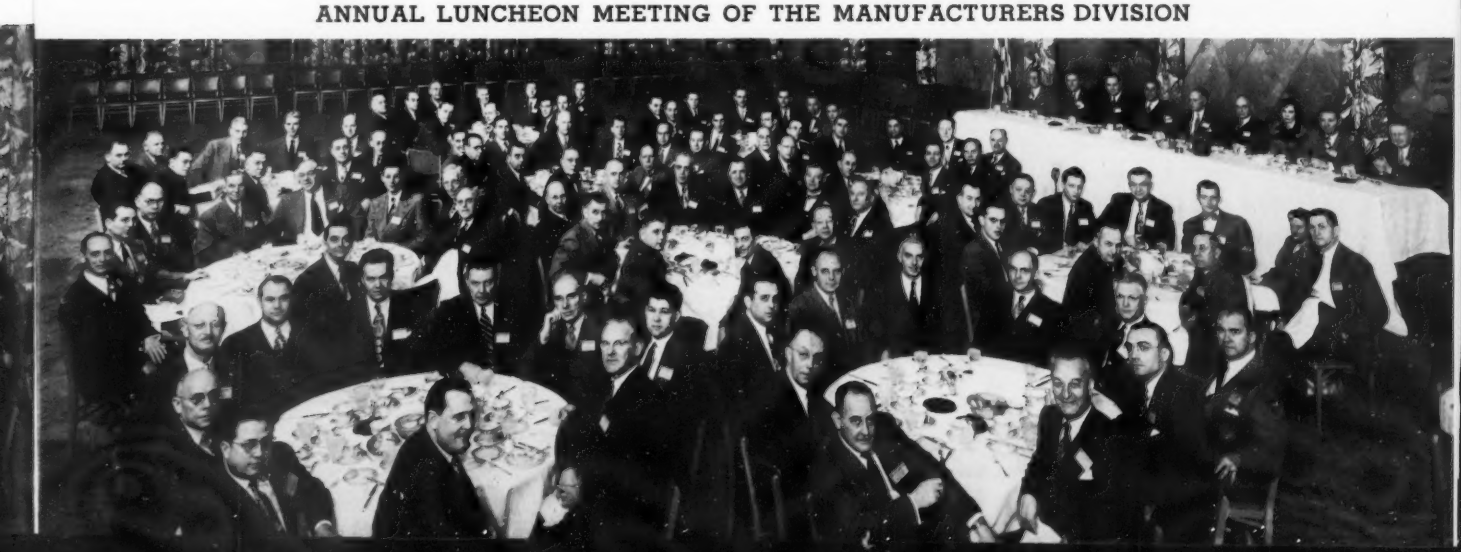
Newly Elected Members of the Board—Manufacturers Division

J. JESS RICHARDS, JR.
Link-Belt Co.,
Philadelphia, Pa.

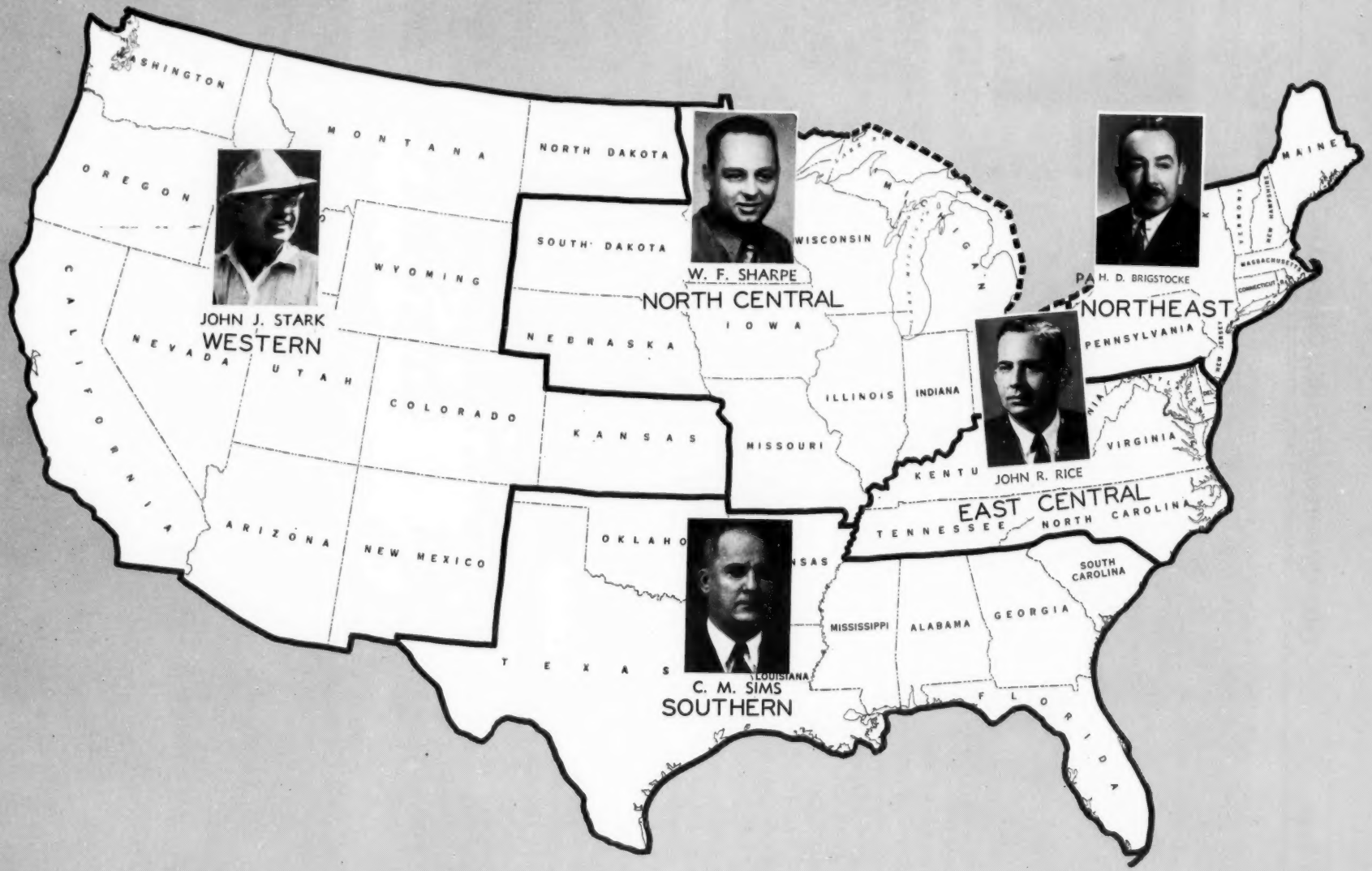
M. L. MCCORMACK
Ingersoll-Rand Co.
New York, N. Y.

R. D. KETNER
General Electric Co.
Schenectady, N. Y.

ANNUAL LUNCHEON MEETING OF THE MANUFACTURERS DIVISION



MAP SHOWING REGIONS AND REGIONAL VICE PRESIDENTS FOR 1949
AGRICULTURAL LIMESTONE INSTITUTE



Agricultural Limestone Institute Holds Successful 4th Convention

THE Agricultural Limestone Institute successfully held its 4th Annual Convention on February 21 and 22, 1949, at the Edgewater Beach Hotel in Chicago, Illinois. Over 225 members and guests of the Institute, who attended the meeting, found the program entertaining and instructive. The objective of the Convention Arrangements Committee to provide information on three major phases of the agricultural limestone business—legal, production, and distribution or merchandising—was attained.

On the first morning, following words of greeting from President Horace C. Krause and the reports of Managing Director Henry A. Huschke and Secretary-Treasurer J. R. Boyd, legal problems were competently discussed by Charles A. Horsky, prominent Washington attorney. He analyzed the labor laws and the antitrust acts and placed special emphasis on the methods of pricing goods since the Supreme Court's decision in the Cement case.

Under Secretary Loveland Is Luncheon Speaker

Following a delightful Greeting Luncheon, those in attendance were privileged to hear an interesting address by the Under Secretary of Agriculture, Albert J. Loveland. Al, as he is affectionately known to his fellow Iowans, complimented the industry on its past record and suggested that increased attention be given to soil testing and improved limestone application. He talked about the importance of a continuing conservation program and highlighted some of the accomplishments of ACP since its inception. His address is reproduced in full elsewhere in this issue of the Journal.

Session on Production Problems

The entire afternoon was devoted to a discussion of production and operating problems. Each of the major subjects on the agenda was introduced by a discussion leader. Blasting was handled by Jules E. Jenkins, Vibration Measurement Engineers, Chicago, Illinois; crushing and grinding by E. Lee Heidenreich, Jr., Newburgh, New York; screening moist materials by C. E. Hogeboom, Consumers Company, Chicago, Illinois; and screening dry materials by J. C. Lawrence, Liberty Limestone Corporation, Buchanan, Virginia. The helpful remarks by these discussion leaders were supplemented by questions and answers from the floor, in which limestone producers and equipment manufacturers freely participated. The session was most instructive and, without doubt, many money-making ideas were taken home by those who attended.

Distribution Talks Feature Second Day

On Tuesday, February 22, there were three excellent talks on problems bearing on the distribution of agricultural limestone.

J. B. Turner, Farm Adviser, Fayette County, Illinois, gave an illustrated talk with colored slides explaining how the tonnage of limestone had been greatly increased in his county by means of an intensive educational program and the development of a stockpiling system so the material is always available.

Dr. R. H. Bray, of the University of Illinois, reported on recent research work which stresses the need for an ample supply of various plant-food elements if maximum crop yields are to be obtained, also the requirement for a high level of organic matter best obtained by growing green-manure crops on properly limed soil. He emphasized the need for soil testing so that fertilizer and lime can be applied intelligently.

A most interesting and helpful discussion on various methods by which limestone producers can promote the sale of their product was presented by W. F. Sharpe, Dillon, Sharpe and Company, Columbus Junction, Iowa. He told about the experiences of his company in using a variety of promotional devices which have effectively stimulated the demand for agricultural limestone.

A feature of the Tuesday luncheon was the inspiring lecture-demonstration by L. F. Livingston, Manager, Extension Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware. He told intimate stories about the development through tireless research of a number of important chemical products such as nylon, polythene, lucite, and others, and how individual enterprisers had found numerous uses for them.

H. A. CLARK
Consumers Co.
Chicago, Ill.
North Central Region

H. C. KRAUSE
Columbia Quarry Co.
St. Louis, Mo.
President,
Agricultural Limestone Institute

A. K. HAUSMANN
Kelley Island Lime & Transport Co.
Cleveland, Ohio
North Central Region

EXECUTIVE COMMITTEE

of the

AGRICULTURAL LIMESTONE INSTITUTE

for the year 1949

P. E. HEIM
Carbon Limestone Co.
Youngstown, Ohio
North Central Region

S. P. MOORE
Concrete Materials and Construction Co.
Cedar Rapids, Iowa
North Central Region

RUSSELL RAREY
Marble Cliff Quarries Co.
Columbus, Ohio
Representing the National Crushed Stone Association

JOHN R. RICE
Liberty Limestone Corp.
Buchanan, Va.
East Central Region

JOHN H. RIDDLE
Riddle Quarries, Inc.
Marion, Kansas
Western Region

E. V. SCOTT
Southwest Stone Co.
Dallas, Texas
Southern Region

NEWLY ELECTED MEMBERS OF THE BOARD

CHAS. E. BAXTER, JR.
Batesville White Lime Co.
Batesville, Ark.

C. A. BERNARD
American Limestone Co.
St. Louis, Mo.

H. D. BRIGSTOCKE
Thomasville
Stone and Lime Co.
Thomasville, Pa.

WM. F. CHILDS, 3D
Harry T. Campbell Sons' Corp.
Towson, Md.

H. A. CLARK
Consumers Co.
Chicago, Ill.

H. C. Krause Re-elected President

At the annual business meeting the Nominating Committee, of which S. P. Moore was chairman, presented the name of Horace C. Krause, President, Columbia Quarry Company, St. Louis, Missouri, in nomination for President of the Institute for the ensuing year. In making the nomination, Mr. Moore said, "We all know . . . that for the past year great service has been rendered to this Institute by the man who has served us as President. It was the unanimous opinion of every man on the Nominating Committee that we place in nomination for re-election as President, Horace C. Krause." Mr. Krause, after expressing his thanks for the opportunity to serve another year, said, "I certainly want to do the things that the entire membership wants done for the industry. We face a lot of problems and we will all need to work together during the coming year." Five Regional Vice Presidents were nominated and unanimously elected as follows:

Northeast—H. D. BRIGSTOCKE
East Central—JOHN R. RICE
North Central—W. F. SHARPE
Southern—C. M. SIMS
Western—JOHN J. STARK

The following list, including the President, five Regional Vice Presidents, and a member of the Executive Committee of the National Crushed Stone Association, comprises the complete Board of Directors which was elected to serve until the next annual meeting:

Board of Directors

H. C. KRAUSE, *Chairman*, Columbia Quarry Co., St. Louis, Mo.

NORTHEAST REGION

Harry E. Battin, Jr., Callanan Road Improvement Co., South Bethlehem, N. Y.
H. D. Brigstocke, Thomasville Stone & Lime Co., Thomasville, Pa.
Otho M. Graves, General Crushed Stone Co., Easton, Pa.

EAST CENTRAL REGION

C. A. Bernard, American Limestone Co., St. Louis, Mo.
W. F. Childs 3d, Harry T. Campbell Sons' Corp., Towson, Md.
S. B. Downing, Jr., Central Rock Co., Lexington, Ky.
Verne C. Morgan, Kentucky Stone Co., Louisville, Ky.
John R. Rice, Liberty Limestone Corp., Buchanan, Va.
B. F. Taylor, Cowan Stone Co., Cowan, Tenn.
F. G. White, M. J. Grove Lime Co., Stephens City, Va.

NORTH CENTRAL REGION

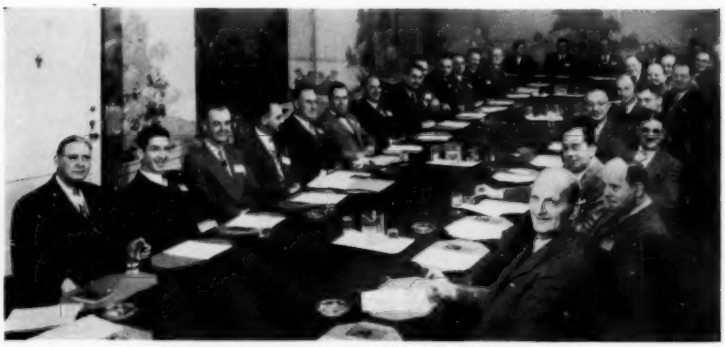
W. L. Bryan, Bryan Construction Co., Northfield, Minn.
H. A. Clark, Consumers Co., Chicago, Ill.
J. L. Fay, Material Service Corp., Chicago, Ill.
A. K. Hausmann, Kelley Island Lime & Transport Co., Cleveland, Ohio

V. C. MORGAN
Kentucky Stone Co.
Louisville, Ky.

W. E. STONE
Piqua Stone Poducts Co.
Piqua, Ohio

B. F. TAYLOR
Cowan Stone Co.
Cowan, Tenn.

D. P. THOMAS
Fort Scott
Hydraulic Cement Co.
Fort Scott, Kansas



Meeting of ALI Board of Directors

L. W. Hayes, L. W. Hayes, Inc., Kansas City, Mo.
P. E. Heim, Carbon Limestone Co., Youngstown, Ohio
W. E. Hewitt, East St. Louis Stone Co., East St. Louis, Ill.
B. G. Lindenfeld, Terminal Materials Co., St. Joseph, Mich.
R. E. Meshberger, Meshberger Stone Co., Inc., Columbus, Ind.
E. V. Meyer, Ed. J. Leary Construction Co., River Falls, Wis.
S. P. Moore, Concrete Materials & Construction Co., Cedar Rapids, Iowa
Paul M. Nauman, Dubuque Stone Products Co., Dubuque, Iowa
A. Overgaard, A. Overgaard Rock Products, Elroy, Wis.
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REPRESENTING THE NATIONAL CRUSHED STONE ASSOCIATION

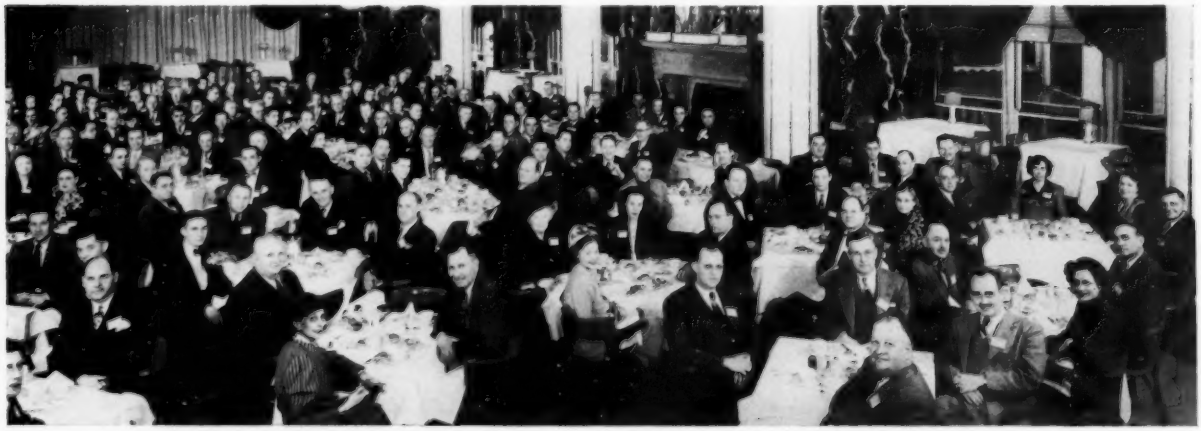
Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio

Board Meets: Elects Executive Committee

The newly elected Board of Directors held its first meeting late in the afternoon of February 22, and elected an Executive Committee composed of the following members:

H. A. CLARK
A. K. HAUSMANN
P. E. HEIM
S. P. MOORE
JOHN R. RICE
JOHN H. RIDDLE
E. V. SCOTT

Also included on the Executive Committee as ex officio members are H. C. Krause, President of the Institute, and Russell Rarey, representing the National Crushed Stone Association. The Board also elected S. P. Moore and P. E. Heim to serve with President Krause on the Board of Directors of the National Crushed Stone Association. J. R. Boyd was re-elected Secretary-Treasurer.



GREETING LUNCHEON—AGRICULTURAL LIMESTONE INSTITUTE

Some Factors Which Affect the Performance of Asphaltic Concrete Pavements[1]

By E. F. KELLEY

Chief, Division of Physical Research
Public Roads Administration
Washington, D. C.

Definition

MANY of the engineering terms which are commonly used do not have clearly defined meanings and it will be well to define what is meant by asphaltic concrete. There may be some slight differences of opinion concerning the matter but, for the purpose of this discussion, asphaltic concrete is defined as a paving mixture composed of coarse aggregate, fine aggregate, mineral filler and asphalt cement, which is mixed at an elevated temperature and spread and rolled while hot. Asphaltic concrete is used in the construction of pavements of the highest type and the exercise of great care in the selection of the constituent materials, the design of the mixture, and the fabrication of the finished pavement is well worth the time and effort required.

There are a number of factors, particularly subgrade conditions and foundation design, which affect the performance of any pavement regardless of type. It is assumed here that the foundation is structurally adequate and this discussion is limited to some of the more important factors which affect the performance of the asphaltic concrete as used in the base course or surface course of the pavement.

The quality of the materials, the design of the mixture and the adequacy of construction practices will all have an influence on the performance of the finished pavement. A comprehensive treatment of all the factors which merit consideration in the design and construction of asphaltic concrete pavements is beyond the scope of any short discussion. It will be possible to deal here with the subject only in rather general terms.

Importance of Quality of Aggregate

The mineral aggregate which is used will constitute more than 90 per cent of the asphaltic concrete and it is manifest that its quality will have a great influence on the performance of the pavement. The coarse and fine aggregate should be characterized by high strength and toughness, fairly low porosity and a greater affinity for asphalt than for water. The coarse aggregate, when crushed, should break into chunky pieces and be relatively free from thin particles or slivers. The hardness and toughness of the coarse aggregate is indicated by the loss in the Los Angeles abrasion test and, in general, this should not exceed 40. Materials having a lower loss should be used if they are economically available. It is important that the aggregates be hard and tough because they must withstand, without undue crushing, the action of the roller during compaction and the subsequent action of traffic. Excessive crushing or degradation of weak aggregates under the roller may so alter the grading and void content as to destroy the proper relation between the amount of aggregate and the amount of asphalt and result in instability of the finished pavement.

The porosity of the aggregate, as measured by its absorption when immersed in water, has an important effect on the adhesion of the bituminous coating and on the amount of bituminous material that will be required to produce a satisfactory mixture. A small degree of porosity, say from ½ to 1 per cent, is advantageous because it permits the asphalt to penetrate slightly into the stone surface and results in better adhesion and an increased resistance to the stripping of the asphalt film from the stone in the presence of moisture. On the other hand, a high degree of porosity as evidenced by high absorption, may be a disadvantage because of the cost of the extra bituminous material that is required to fill the surface voids. It should be noted that in the case of blast-furnace slag, which may have absorptive values as high as 5 or 6 per cent, the cost of the extra bitumen required to compensate for absorption may be entirely offset by the fact that the slag, having a much lower specific gravity, yields more square yards of pavement per ton than does stone.

Failure Due to Stripping

One important cause of the failure of bituminous pavements in service is commonly called stripping

[1] Presented at the 32nd Annual Convention of the National Crushed Stone Association, Hotel New Yorker, New York, N. Y., February 7-9, 1949

because, in the presence of moisture, the films of asphalt lose their adhesion to the particles of aggregate and are stripped from them. The resulting lack of bond between the asphalt and the aggregate tends to destroy the stability of the mixture. Stripping is prevalent with certain aggregates and not with others. Those which strip have a greater affinity for water than for asphalt and are called hydrophilic. Those which do not strip have a greater affinity for asphalt than for water and are called hydrophobic.

Stripping in bituminous mixtures appears to have become increasingly prevalent in recent years and to present much more of a problem than it did in the past. Why this is so is not entirely clear since essentially the same types of aggregate that were used formerly are still used. A possible explanation is in the greatly increased use of bituminous mixtures for the resurfacing of old portland cement concrete pavements. Our older asphaltic concrete pavements were commonly placed on relatively pervious base courses of stone or gravel. These did not tend to trap and hold water. In contrast, the old portland cement concrete pavement, when used as a base course, is ideal for trapping and holding water, resulting in saturation of the lower part of the bituminous concrete surfacing. If this occurs the churning action of traffic may be expected to produce stripping in bituminous mixtures which are not resistant to this action. Whether or not this is a correct or complete explanation is immaterial. The fact remains that stripping is prevalent and it is important because of the increasing use of bituminous concrete for resurfacing old concrete pavements.

Effect of Water on Bituminous Coated Aggregates

Several tests have been developed for studying the effect of water on bituminous-coated aggregates or bituminous paving mixtures and two of these will be described.

The first of these, the static immersion test, is a stripping test applicable only to coarse aggregates. In this test the coated aggregate is immersed in distilled water which is maintained at an elevated temperature, usually 120 F. or 140 F., for a definite length of time, usually 24 hours. A visual examination is then made to determine the percentage of area of aggregate which remains coated. Important criticisms of this test are that the results are determined by visual examination and thus are lacking in accuracy; that it is applicable only to the coarse aggregate although the fine aggregate and filler have an important effect on the water-resistant properties of a mix; and that it does not indicate the effect of moisture on the paving mixture as a whole. It is of limited value in the selection of materials for bituminous concrete but has an application in the selection of coarse aggregates for surface treatments or macadam construction. It has also been used to some extent to determine the relative merits of asphalts that have been treated in various ways to increase their resistance to stripping.

The second test for studying the effect of moisture is the immersion-compression test and this is applicable to the paving mixture as a whole. In this test the paving mixture composed of the coarse aggregate, fine aggregate, filler and asphalt, in the proportions desired for investigational purposes or for use in actual construction, is molded under pressure into 4-in. by 4-in. cylindrical test specimens. After the specimens have been cured, one set is tested to determine its compressive strength. A duplicate set of specimens is immersed in water which is maintained at some elevated temperature and soaked for a definite length of time, usually four days. The soaked specimens are then tested in compression and any loss in strength, resulting from the action of water, is determined. Loss of strength in the test may be the result of film stripping or it may result from other causes. The fault may lie in the coarse aggregate, the fine aggregate, the filler or the bituminous binder, or it may be in the design of the mixture as, for example, a deficiency of bitumen or an unsatisfactory grading of aggregate. Whatever the cause, the value of the test lies in the fact that it identifies mixtures that are susceptible to water. If serious losses in strength develop in the test, it may then be possible by varying the constituents to determine and correct the defect. As applied to asphaltic concrete specimens soaked for four days in water held at a temperature of 120 F., the mix is considered defective in some respect if the strength of the soaked specimens is less than 75 or 80 per cent of that of the dry specimens.

Results From Immersion-Compression Test

While on the subject of the immersion-compression test it will be of interest to review briefly some of the findings that have resulted from its use in research work. The importance of the coarse aggregates on the behavior of bituminous mixtures has been demonstrated. There is a wide range in the results obtained with the aggregates commonly used in bituminous pavements. This is true not only with

respect to different types of stone but also there is a wide range in quality of stone of the same type from different sources. For example, mixtures using limestone as coarse aggregate generally have a good resistance to the action of water but there is a considerable range in the quality of different limestones. Similar differences, although of lesser extent, have been found with trap rock. Granites range from good to bad and quartzites have been found to be the poorest of the coarse aggregates studied.

It has been shown that the quality and quantity of the sand and filler have a considerable effect on the resistance of mixtures to the action of water and that in some cases these materials are more important than the coarse aggregate. A high percentage of filler of good quality may sometimes be used to overcome the adverse effect of a less satisfactory coarse aggregate. Silica dust is a definitely inferior filler. It has also been observed that some fillers that behave reasonably well with coarse aggregate produced from their own parent rocks give poor results with other coarse aggregates that are known to be of acceptable quality.

While the immersion-compression test has shown that the quality of the mineral aggregates is highly important, it has also shown that their deficiencies are not the sole cause of low resistance to the action of water. The characteristics of the bituminous binder must also be considered. In one series of tests three asphalt cements of the same penetration grade (85-100) were combined in the same proportions with granite coarse aggregate, sand and limestone dust. Solely because of differences in the asphalts, the retained strength of the soaked specimens ranged from 50 to 76 per cent of that of the dry specimens.

Anti-Stripping Agents

The discussion of the effect of water on bituminous-coated aggregates and bituminous paving mixtures would not be complete without mention of the anti-stripping agents that have been developed in recent years. These are additives for the treatment of the asphalt to overcome the deleterious effects of water, and a number of them are on the market. First of all, they are wetting agents which make it possible to coat wet aggregates with asphaltic materials. However, this is not a matter of consequence with respect to asphaltic concrete in which the aggregates are preheated and dried. Second, they are intended to improve the adhesion of bituminous films to aggregates in the presence of moisture and thus make possible the use of aggregates or asphalts which otherwise would be unsatisfactory.

Laboratory tests with bituminous mixtures in which cutback asphalts were used as the binder have indicated that some of these anti-stripping additives may be very effective in increasing the resistance to water of mixtures of these particular types. Worthy of note is an indication of these tests that an additive which is effective with one aggregate is not necessarily equally effective with all other aggregates. But these findings pertain to mixtures which contain cutback asphalts and which are mixed at normal or only slightly elevated temperatures. They do not necessarily apply to asphaltic concrete which contains asphalt cement and is mixed at a relatively high temperature. A definite statement cannot be made at this time but there is some evidence to indicate that at least some of the additives may not be particularly effective in preventing stripping in hot-mixed asphaltic concrete.

Of possible importance in this connection are the results of recent tests of hot-mixed asphaltic concrete in which small percentages of hydrated lime were added to the aggregate after the addition of the bituminous material. An addition of as little as ½ per cent of hydrated lime to mixtures containing aggregates that otherwise were very unsatisfactory resulted in a remarkable improvement in the resistance to the action of water.

Mineral Fillers to Increase Density and Stability

Mineral filler, also called fines, filler or dust, is a finely divided mineral material of which a high percentage is required to pass the No. 200 sieve. Its use in asphaltic concrete is frequently required to increase density and stability. The grading of filler below the No. 200 sieve is not controlled by specification requirements although particle size distribution is of some importance. Fillers are graded from the No. 200 sieve downward to impalpable dust but occasionally a filler is encountered in which the particles are all of essentially the same size. Such fillers are practically useless because they are not effective in reducing voids and thus increasing density.

The importance of the quality of the mineral filler, as it affects the resistance of bituminous mixtures to the action of water, has already been indicated. Limestone dust is a very satisfactory material and is used widely because of its good performance and low cost. Portland cement is also recognized as a good filler but its use is somewhat limited because of its

relatively high cost. Recent studies with the immersion-compression test have shown that some trap-rock powders and some fly-ash materials produced in coal-fired power plants also have merit as fillers.

Characteristics of Bituminous Material

The final ingredient of the asphaltic concrete mixture which requires consideration is the bituminous material itself. The primary purpose of asphalt in asphaltic concrete is to bind the aggregate particles together and waterproof the structure. Thus the asphalt should have good adhesion to the aggregate particles, a high cohesive strength, and should impart adequate ductile properties to the finished pavement. It should also have a high resistance to deterioration caused by weathering. Lacking this property, the pavement may crack and disintegrate.

When asphalt cements are exposed to the relatively high temperatures which are required in mixing and, in the finished pavement, to the influence of weather, they tend to become harder. This hardening is evidenced by a decrease in penetration and ductility and an increase in softening point.

Asphalt is produced from crude petroleum from many sources and by a variety of processes of refining. The result is that actually there are numerous varieties of asphalt cements that will all meet the requirements of the present standard specifications. All asphalts harden to some extent upon exposure to heat and weathering but some of these varieties harden more than others. Studies of asphalt cements recovered from pavements that have been in service for various periods have shown that penetration, ductility and softening point can be correlated with pavement condition. Unduly low penetration and ductility and unduly high softening point are associated with pavements that have failed by cracking and disintegration. Thus the character of the asphalt used in asphaltic concrete affects the durability of the finished pavement. As yet no tests for measuring the durability of asphalts have received general acceptance although the thin-film oven test [2] gives promise of being a useful test for this purpose. About the most that can be said at present is that asphalts refined from asphaltic-base petroleums by steam or vacuum processes generally have good qualities initially and are more resistant to deterioration than are asphalts produced by cracking processes. The latter generally have a high initial susceptibility to changes in consistency with changes in temperature and harden rapidly during mixing and weathering.

[2] *The Properties of the Residues of 50-60 and 85-100 Penetration Asphalts from Oven Tests and Exposure*, by R. H. Lewis and J. Y. Welborn, Public Roads, April 1941.
Behavior of Asphalts in Thin-Film Oven Test, by R. H. Lewis and W. J. Halstead, Public Roads, April-May-June, 1946.

Mixing Temperature and Time

Investigations have shown that an asphalt may harden more during the mixing process than during a subsequent period of several years of exposure in the pavement. Therefore it is highly important that both the mixing temperature and the time during which the mixture is maintained above normal temperature be held to the minimum required to obtain adequate coating of the aggregate particles and satisfactory workability of the mixture during spreading and rolling.

Different asphalts have different susceptibilities to temperature. That is, at a certain elevated temperature, one asphalt may be less viscous, or more fluid, than another. In mixing asphaltic concrete it is necessary to heat the asphalt so that it will be sufficiently fluid for the purpose but the use of a higher temperature than is required to produce the requisite fluidity is not only unnecessary but results in undue injury to the asphalt. It would be advantageous to use a mixing temperature no higher than is necessary to produce the required degree of fluidity in the particular asphalt which is being used, rather than to heat all asphalts to some arbitrary temperature within the usual specification limits.

Effect of Hardness on Durability

As has been indicated, the ultimate hardness of the bituminous binder influences the durability of asphaltic concrete pavements. If the asphalt becomes too hard the pavement disintegrates. Also, past investigations have shown that, when subjected to the same influences which promote hardening, the softer asphalts (those of high penetration) remain softer than do the harder asphalts (those of low penetration). Therefore it is indicated that it will be advantageous, from the standpoint of durability, to use the softest asphalt in bituminous concrete pavements that is consistent with the stability of the mixture required by the traffic and climatic conditions to which the pavement will be exposed. Other things being equal, a hard grade of asphalt will produce a more stable mixture than a soft grade. However, it is often possible to compensate for a lowered stability resulting from the use of a

soft grade of asphalt by making slight changes in the grading of the aggregate with a resulting increase in the stability of the mixture as a whole. The full advantage of using the softer grades of asphalt will not be attained if the mixing is not done at the lowest temperature possible, consistent with having the asphalt in a sufficiently fluid state.

Density and Stability of Primary Importance

The two characteristics of an asphaltic concrete paving mixture that are of primary importance are density and stability. The density of a mixture, which is inversely proportional to its void content, is important from the standpoint of durability. Mixtures of high density and low void content are resistant to the entrance and circulation of water and air and therefore, as compared with mixtures of low density and high void content, are more resistant to the detrimental effects of water and to deterioration of the asphalt by oxidation. The stability of a bituminous pavement is its ability to resist shoving and rutting caused by the loads imposed by the wheels of vehicles.

Density is a property of asphaltic concrete that is dependent almost entirely on the grading of the aggregate. Thus, through its influence on density, the aggregate grading becomes a factor of great importance in its effect on the durability of the finished pavement. The attainment of a consistently dense pavement requires careful attention to grading of the aggregate both in the design of the mix and, during construction, in the control of the grading that has been selected. Workability of the mixture is also largely dependent on the aggregate grading. High densities may be obtained both with harsh working mixtures and with the more workable mixtures that are characterized by relatively high contents of sand, filler and asphalt. The harsh mixtures tend to be the more stable of the two types. The greater difficulty of their placement, which existed when hand methods were in vogue, has been largely eliminated by the introduction of machine spreaders. In harsh mixtures there is a greater tendency than in the more workable mixtures for the coarse aggregate to crush under the roller. Therefore, the coarse aggregates used should be characterized by high strength and toughness as evidenced by a low loss in the Los Angeles abrasion test.

Control of Particle Size

The mineral aggregate is divided into two principal size fractions, coarse and fine. It is convenient to separate the two fractions by means of the No. 8 sieve, the material retained on that sieve being the coarse aggregate and the fraction passing the No. 8 and retained on the No. 200 sieve being the fine aggregate. The maximum size of the coarse aggregate is a variable depending to a great extent on the preferences of the engineer. A maximum size of 2½ in. is sometimes used in relatively thick courses but the more common practice is to use a maximum size of the order of 1 in. In any case the maximum size should be somewhat less than the thickness of the course in which it is used.

An essential factor in the control of grading or particle size distribution in the bituminous mixture is the relation between the two size fractions and the grading of each. The filler should be considered separately as a means for increasing the density of the aggregate only after the best possible combination of the coarse and fine aggregate has been determined. If this approach is used it may be found that little or no filler is required in excess of that naturally present in the coarse and fine aggregate. Generally, however, some additional filler will be needed in order to reduce the voids in the compacted aggregate as a whole to a desirable minimum of the order of 15 or 16 per cent. This percentage of voids will provide space for the bituminous binder and still leave a small percentage of air voids in the finished pavement after compaction. From 3 to 6 per cent of air voids should remain in the pavement after final rolling to provide for the additional compaction that will take place under traffic. If this provision is not made, the additional compaction that will take place may cause the asphalt to flush to the surface and result in a slippery pavement.

Factors Influencing Selection of the Asphalt Content

The selection of the asphalt content of a dense bituminous concrete depends on such factors as the maximum size of the coarse aggregate, the proportions of coarse and fine aggregate, the percentage of voids in the compacted aggregate, and the absorptive properties and surface texture of the aggregate particles. Depending on these characteristics the bitumen content of asphaltic concrete may range from 4 to 8 per cent by weight of the mineral aggregate. The most important limit in a dense mixture is established by the percentage of voids in the aggregate when compacted to a condition approximating ultimate density. Good practice limits the bitumen content to a volume which fails to fill these voids

by 3 to 6 per cent. Within these limits the highest bitumen content consistent with adequate stability is advocated. The intent is to provide relatively thick weather-resistant films of bitumen on the aggregate particles and a resulting pavement that will be highly resistant to the intrusion of water.

Having determined in advance of construction the grading of the aggregate and the proportion of bitumen it is highly important, during construction, to maintain within practical limits the uniformity of grading and proportions. Lack of uniformity results in a pavement of variable density and stability and one having an unsightly surface texture.

Factors Influencing Stability

Stability, as has been said, is the ability of a bituminous pavement to resist the forces of traffic that tend to produce rutting and shoving. It depends on the internal friction and cohesion of the mixture. The cohesion is furnished by the bituminous binder and is somewhat greater for the low penetration asphalts than for the softer ones of higher penetration. However, it is of less importance than the internal friction which is provided by the interlocking of the aggregate particles. As a class, asphaltic concretes containing coarse aggregates of high angularity have a high degree of stability. Generally, the addition of large amounts of filler to such mixtures for the purpose of increasing stability is not necessary and frequently the only filler material needed is that naturally contained in the aggregate. On the other hand, in bituminous concretes containing non-angular aggregates mineral fillers are very useful in producing a satisfactory degree of stability.

The stability of a bituminous pavement should be related to the amount and character of traffic that is expected to use it. Pavements carrying traffic of high density with a large percentage of heavy vehicles should have a much higher stability than pavements carrying traffic of low density with a small number of heavy vehicles. Also, pavements should not be designed with a stability greatly in excess of that required for the expected traffic. Freedom from cracking in a bituminous pavement is dependent, among other things, on the kneading action of traffic and pavements of high stability require more of this kneading action than do those of low stability. It has been observed repeatedly that pavements having a stability greatly in excess of that required are disposed to crack and ravel.

A number of tests have been developed for measuring the stability of bituminous mixtures. All of them are empirical tests and all are useful for measuring the relative stabilities of various mixtures available for a given job. A greater usefulness would result from the correlation of test results with pavement performance but this has not progressed sufficiently to establish with any precision the stabilities required for various intensities of traffic. At the present time the attainment of adequate stability is dependent primarily on the experience, judgment and skill of the engineer who designs the mixture.

Importance of Construction Practices

The preceding discussion has been concerned with the selection and proportioning of materials that will result in a durable and satisfactory pavement. However, these objectives will not be achieved if strict attention is not given to the adequacy of construction practices. Highly efficient construction equipment is readily available and failure to obtain good pavements with properly designed mixtures can be attributed only to the use of equipment of inadequate capacity, to lack of its proper operation and maintenance, or to inadequate supervision and inspection.

Construction equipment and construction practices are subjects in themselves and cannot be dealt with here in any detail. They will be summarized by brief mention of some of the more important items. Efficient operation and good construction depend on the use of driers and screens of adequate capacity, on the use of storage bins designed to prevent segregation of the screened material, on the use of a mixer that will produce a homogeneous mixture in the shortest possible time, on the use of spreaders that will lay the mixture uniformly without segregation, and on the use of rollers which will provide the desired degree of compaction without excessive crushing of the aggregate. At the mixing plant the grading of the aggregates and the proportions of the mix must be closely controlled within the limits which have been established for the job. Throughout the entire operation temperature control is of the greatest importance. To avoid undue hardening of the asphalt the temperature of the mix should be held as low as possible consistent with the production of a homogeneous mixture and the delivery of the mixture to the pavement at a temperature high enough to permit proper compaction under the roller.

Summary

A number of factors have been enumerated as having important influences on the performance of

(*Continued on Page 24*)

The Long-Range Needs of the Agricultural Conservation Program[1]

By ALBERT J. LOVELAND

Under Secretary of Agriculture
U. S. Department of Agriculture
Washington, D. C.

I AM glad to be with you—for many reasons. One reason is that you're business people and I'm a farmer—and I think business people and farmers ought to get together often to talk over their mutual problems. We have learned in recent years that economic groups in this country *have to* work together. It's to their own self-interests to do so. Economically, they go up and down together—industry, agriculture, and labor.

One of our mutual problems—the one that I want to talk about today—is conservation—and what's ahead for conservation. But, of course, we can't separate conservation from the whole agricultural picture. So let's take a long look down the road to get some idea of what's ahead for agriculture.

The first thing that I see as I look ahead is the continuance of abundant production. We must have abundant farm production if the American people are to have the food and fiber they need at prices that are reasonable. Our people in 1948 ate 12 per cent more food per capita than in the years from 1935 to 1939, and still they had less of some foods than they actually wanted. They had less meat than they desired. The short corn crop of 1947 helped produce a meat shortage in 1948. This shortage forced meat prices up so that many families were literally priced out of the market. The people would also have consumed more milk had it been available.

From the standpoint of the American consumers' need and desire, therefore, continued agricultural abundance looms on the horizon.

High Farm Production Needed

But we need abundance for another reason. Our nation is today indisputably the leading nation of the world. In this period of turmoil—of rehabilitation—of readjustment to postwar conditions—American food has played a gigantic role. We have been exporting about 20 million tons of food a year to the people of other lands. Half the wheat moving in international trade has been wheat from the United States. A large part of the European Recovery plan is based upon shipments of American food to the struggling people of Western Europe.

We hope that when these nations are on their feet again, they will provide a reasonably large market for our food and fiber. Certainly, the diet of the people of Europe has a long way to go before it can be considered adequate for healthful and efficient living.

There is still a third reason why we may look forward to a continuance of agricultural abundance in the future. That reason is the revolution in farming which has come about in the past quarter century. We now produce per hour of farm work about three-fourths more than 25 years ago. Last year's farm output exceeded the 1935-1939 average by 41 per cent.

New machinery, new varieties of plants and seeds, new insecticides and fungicides, more lime and fertilizer—these are some of the reasons for the agricultural revolution. The use of nitrogen and phosphate has more than doubled since before the war. As for the use of lime, the story is one of almost fantastic growth over the past 15 years. In 1933, at the depths of the depression, farmers spread only one and half million tons. In 1935—a more nearly normal year—they spread three million tons—about the same as in 1929.

Then something happened, and we all know what it was.

ACP Stimulates Liming

In 1936 the Agricultural Conservation Program came into being. Use of lime doubled, then tripled. In 1947 it was ten times the 1935 consumption—and four times the 1935-39 average.

This was a part of the agricultural revolution. Indeed, it is the only significant part of that revolution which farmers might be forced by economic necessity to give up in case of a period of low prices. What I am saying is that, even in the event of hard times, farmers will keep their machines, their new

[1] Presented at the Fourth Annual Convention of the Agricultural Limestone Institute, Chicago, Illinois, February 21, 1949

varieties, their insecticides, their better farming methods. They will, in other words, keep their ability to produce in abundance. They might, however, cut down somewhat the use of lime and fertilizer. And this, of course, illustrates the importance of farm prosperity to your industry.

Well, that is the first thing we see as we look down the road—the continued need, and the continued capacity, for abundance.

But we see something else. We see a great urgency to protect our land resources against waste—erosion—depletion.

Conserve or Perish

We have only to spin the globe to see circling before our eyes numerous civilizations which lived—abused their land—and died. The map of the world is a vivid reminder of the rise and fall of nations. Soil scientists tell us that after the Romans denuded the forests, the northern shores of the Mediterranean Sea lost their ability to feed and clothe the people living there. In Yugoslavia today the shore lands are barren. Pelting rains wash away the soil. And those who have visited the site of ancient Corinth tell us that this once proud capital of Grecian culture is now covered with a forty-foot accumulation of dirt and debris—dirt washed down from the hills after the vegetation that nature put there and that held the soil in place had been removed.

Fortunately, we are not in that kind of danger here. We still have enough good land to provide our people indefinitely with the best diet any nation ever enjoyed. But we shall continue to so provide only if we protect that land against wasteful farming practices.

Must Shift to Grasses

What I have said so far leads to the next point I want to make—namely, the need for shifting more and more to grassland farming. Our people, when they are relatively prosperous, demand larger quantities of meat and dairy products. They would like to consume more of these products than have been available to them in recent years. Increased livestock and dairy production lead us in the direction of more grassland farming. Our conservation requirements urge us in the same direction. Land that is under grass is safe land.

What more grassland farming means to the limestone industry, you know as well as, or better than, I.

I am sure that you are well aware of the kinds of assistance in applying conservation practices that are offered through the Agricultural Conservation Program. Some three million farmers are cooperating in this program. Their farms include nearly two-thirds of all our cropland.

ACP Accomplishments

Let me call off for you some of the outstanding achievements which were brought about by farmers cooperating in the ACP for 1947.

Standard terracing built—87,000 miles.

Acres terraced—1½ million.

Acres strip-cropped—7 million.

Acres of cropland farmed on the contour—8¾ million.

Acres receiving lime—14½ million. Nearly 30 million tons applied.

Acres of cover and green manure crops planted—18½ million.

Acres of soil-conserving crops treated with phosphate—21 million. Almost three million tons applied.

Those are the figures for the 1947 program—one year.

But the program had operated for eleven years previously. And the total figures for the twelve-year period are *really* something.

Standard terraces built under ACP in this twelve-year period would measure 700,000 miles. Just for illustrative purposes that's three times the distance from the earth to the moon.

Lime has been spread on more than a hundred million acres—and the total quantity of lime applied under ACP programs amounts to about one hundred eighty-six million tons.

All this, however, is in the past. You are interested in the future. What are the needs for limestone if our acres are to be properly cared for?

More Lime Required

During the war, the Department worked with state technicians to estimate, county by county, and state by state, the quantity of limestone the farmers of the nation should use each year. Since that survey was made, and in the light of our growing need for more grassland farming, the requirements have been reconsidered and recalculated. We still cannot say with mathematical accuracy what our total requirements are; but if, in the past we had applied all the lime necessary to bring our acres into proper balance, it is estimated that we would need 70 million tons a year to maintain that balance.

Obviously, then, agricultural use of limestone now falls far short of needs. In 1947—which was your

best year up to then—the industry's sales topped 30 million tons.

Actually, however, getting enough lime applied to the land is only part of the problem. It must be applied in the proper quantities, which vary with different kinds of land and crops.

Test Soils and Apply Properly

The proper application of lime has become an important field in agricultural research. Most of the states are now doing experimental work in limestone utilization—not only as regards quantity of application, but with respect to the effects of finely ground or coarsely ground limestone. Use of lime with different crops and in various rotations is also being studied.

We are greatly interested, too, in the relation of the nutritive value of food to the mineral content of the soil. Experiments have shown that food grown on mineral-rich soil will normally be rich in minerals. This doesn't mean that putting minerals on the land will give tomatoes more vitamin C. Minerals will not replace sunshine. Nor does it mean that applying lime to the land will prevent heart disease or cancer. What I mean to say is simply this: Liming pastures, for example, has a direct effect upon the nutritive value of the grasses produced—because it changes the types of plants which flourish—because the pasture then produces less weeds, and more clover and legumes and grasses with high nutritive qualities.

We now have simple, accurate soil tests which can help farmers determine the proper amount of lime for their land. You of the limestone industry should make it your business to urge farmers to use these tests. It is to your interest—to the farmer's interest—and to the interest of the entire country that lime be applied in the most effective manner.

Your industry has proven that it can make big strides in marketing. I need only refer to the fact that today a large part of the lime is spread as it is delivered. This saves labor. It saves cost. It is a real marketing improvement. It helps to get the conservation job done.

We in the Department hope for more progress of this kind from your industry in the future. Our conception of your job is that it is much more than a "selling" operation. It is an educational operation. It demands a certain aggressiveness on your part. It demands a degree of pioneering. It demands understanding of the fact that while the proper use of limestone is its greatest advertisement, the improper use of it is not a boost but a knock.

We urge you to increase your efforts to help farmers appreciate the need for limestone, and the proper use of it. Thus your industry will contribute to conservation—to abundance—and to the health and vitality of the whole American people. Cooperation of this nature is the key to a sound and prosperous future for all the economic groups of the country.

Farm Income and Conservation

As we look toward that future, I am sure that all of us realize that much remains to be done before lasting abundance and the preservation of our productive resources will be achieved. Much of our land is still subject to erosion. Much of it is still being depleted by unwise farming methods. And even on a lot of land where improved farming practices have been introduced, we must all realize that individual practices have not yet been woven into a system of farming that will maintain that land permanently productive.

For the calendar year 1949 the ACP has a total authorization of 262½ million dollars, considerably more than for the 1948 program. This should permit an increase in liming operations over last year. But looking ahead, we can see that many other conservation practices need to be put to use.

Experience has amply proven what happens when farmers are forced by low prices to choose between preserving their land and preserving their living standards. When it is a choice between shoes and clothing for the children on the one hand, and a soil conservation practice for the land on the other, who can blame the farmer if he elects to think first of the immediate needs of his family?

During the war and since, American agriculture has been hard pressed to provide food and fiber enough to meet demand. Last year, for example, we produced by a considerable margin the largest total quantity of crops in our history. Yet the damage to our land in 1948 was much less than the drain resulting from the far smaller production of 1932, when farmers were caught fast in the grip of the worst depression they have ever known.

What I am driving at is this: There is no fundamental conflict between abundant prosperity and conservation. There *is* very definitely a conflict between depression and conservation.

Farm Prosperity Based on Demand

Farmers and their organizations, and the Department of Agriculture, have all been doing a great

deal of thinking these past years about ways and means to achieve and maintain a high degree of agricultural prosperity. There are certain basic requirements which must be met.

The first requirement is ample buying power in the hands of consumers. This implies full production in industry, and full employment at good wages. This is the most important single element in farm prosperity—and intelligent farmers are not forgetting it for a moment.

Nor are farmers forgetting the second element necessary to long-range prosperity—a reasonable foreign market. In the past we have needed foreign outlets for cotton, wheat, tobacco, lard, and certain fruits and vegetables. We shall need outlets for these crops in the years ahead. I might remind you that while our aid to Europe is humanitarian, it is also practical. Western Europe normally has taken from 60 per cent to 75 per cent of our agricultural exports. Unless these nations can be helped to their feet economically, we cannot expect them to be able to buy the food their people need.

In the field of foreign trade, we are also striving with other nations to work out a world wheat agreement so that the surpluses of exporting countries may be made available in orderly fashion to fill the needs of wheat-deficit nations. If we can work out a satisfactory agreement on wheat, perhaps other arrangements for other crops may follow.

High Consumption, Price Supports, and Storage

A third element in providing markets for agricultural abundance consists of practical programs to *use* that abundance. Even in good times many families here in the United States are undernourished. In bad times the number is far larger. There is need, then, for expansion in programs to make available to low income groups a larger portion of our agricultural production. There is still plenty of room for expansion of the School Lunch Program. There is room, too, for some kind of food allotment plan under which low income families would be able to supplement their food purchases.

A fourth element consists of programs which help producers and consumers alike to withstand unusual crop conditions. We need price support programs that will encourage abundance, but will not be an incentive to over-production. We need storage programs so that in time of extraordinarily large crops, we may put aside reserves against the day when drought or flood may bring about a short crop. We need programs to give agriculture as much stability as it is possible to achieve.

We need expanded research to lower costs and increase efficiency in production and marketing.

And finally, we need programs to help farmers share equally in the conveniences and joys of the modern day. Most rural areas now lack parity in such essential fields as health facilities, education, and housing. Per capita farm income still is only about three-fourths as high as per capita non-farm income. Farm people deserve an equal share in our national abundance. Only when they have an equal share, will they be as efficient—as healthy—and as happy as the best interests of the nation demand.

The welfare of your industry is directly connected with the welfare of agriculture. I urge you, therefore, to acquaint yourselves with all the farm programs—not only the ACP in which you are most directly interested, but with *all* our programs. I urge you to get a real and complete understanding of these programs. I urge you, further, to spread that understanding among your business acquaintances. For only out of mutual understanding does real cooperation grow. And only out of real cooperation between all economic groups in our nation can we rise to the great era of abundant prosperity which is now almost within our grasp.

Some Factors Which Affect the Performance of Asphaltic Concrete Pavements

(*Continued from Page 20*)

asphaltic concrete pavements. Briefly, these are the quality of the coarse and fine aggregates, mineral filler and bitumen; the grading of the aggregates; the proportioning of the aggregates and bitumen to produce a mixture of high density and adequate stability which will be resistant to effects of water and weathering; and finally the proper use of suitable construction equipment and close supervision and control of all the construction operations. Asphaltic concrete is one of the highest types of bituminous pavement and it is apparent that the production of a pavement of this type which will give satisfactory service is not a simple matter. It requires knowledge gained by study and practical experience and close attention to detail. The attainment of the desired results will provide ample compensation for the time and effort expended on meticulous attention to the details of design and construction.

NCSA Holds Third Short Course for Crushed Stone Salesmen

By A. T. GOLDBECK

Engineering Director
National Crushed Stone Association
Washington, D. C.

ON FEBRUARY 2 to 5 inclusive, the Third Short Course for Salesmen was conducted by the National Crushed Stone Association. During the first three days, sessions were held in the beautiful "Hall of Flags" of the United States Chamber of Commerce Building in Washington, and on the morning of Saturday, February 5, those attending were given a demonstration of test methods in the Association laboratory.

As will be seen in the accompanying photograph taken at the close of the first session there was an excellent attendance, about 100 representatives from 37 companies and, in addition, the audience included engineers from several government departments who were attracted by their interest in the subjects presented.

Why A Short Course

The Association endeavors to be of the greatest possible service to its member companies, and the Short Course is one of its services. Crushed stone is used in a variety of ways, many of them involving intricate technical problems with which salesmen should be somewhat familiar so that they might offer the greatest possible assistance in supplying the consumer with the kinds of stone best suited for the job. A better understanding of these problems undoubtedly helps the salesmen to fully comprehend what the engineer is trying to accomplish and why the specifications for materials have particular requirements. Full information regarding his product is desirable equipment for any salesman; the job is made more interesting and undoubtedly the informed, helpful salesman can most effectively promote sales. With these thoughts in mind a program was presented which included topics about which every crushed stone salesman should have some information.

The Program

The program of lectures was presented by members of the National Crushed Stone Association staff and by other engineers who have had long experience and who are regarded as outstanding experts in their fields. The policy of short, concise talks, with discussion and rest periods interspersed was adopted, and as a result, the interest of the audience was maintained continuously. Small details such as the use of a special black board, well lighted, well braced, and visible from every seat were not overlooked for such details can make or mar the success of the presentation.

Speakers

The speakers in alphabetical order were as follows:

John S. Biggs, Jr., Engineer, National Crushed Stone Association, Washington, D. C.

Carl A. Carpenter, Senior Materials Engineer, Public Roads Administration, Washington, D. C.

Paul Critz, Senior Civil Engineer, Public Roads Administration, Washington, D. C.

George H. Dent, District Engineer, Asphalt Institute, Washington, D. C.

James W. Feild, Sanitary Engineer, Engineering Division, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

A. T. Goldbeck, Engineering Director, NCSA, and Director of Short Course, Washington, D. C.

J. E. Gray, Field Engineer, National Crushed Stone Association, Washington, D. C.

Herbert Insley, Chief, Mineral Products Division, National Bureau of Standards, Washington, D. C.

George E. Martin, Consulting Engineer, The Barrett Division, Allied Chemical and Dye Corp., New York, N. Y.

E. V. Scott, Assistant General Manager, Southwest Stone Co., Dallas, Texas

Fred E. Swineford, Engineer Director, Macadam Pavements, Inc., Columbus, Ohio

D. O. Woolf, Senior Materials Engineer, Public Roads Administration, Washington, D. C.

Subjects of Talks

Included in the program were the following topics:

Origin, Geology and Classification of Rocks — Dr. Insley

Gradation of Aggregates, Sieves, Maximum Density —Mr. Gray

Specific Gravity, Absorption, Solid Volume and Voids —Mr. Goldbeck

The Proportioning of Concrete—Mr. Woolf

How Aggregates Affect the Behavior of Concrete Pavements—Mr. Goldbeck

Bituminous Binders — Classification, Characteristics and Best Use for Different Grades:
(a) Asphalts—Mr. Dent
(b) Tars—Mr. Martin

The Composition and Characteristics of Bituminous Mixtures and Conditions for Which They are Best Suited—Mr. Carpenter

Bituminous Surface Treatments—Mr. Critz

The Problem of Flexible Pavement Design — Mr. Goldbeck

Macadam Roads—Mr. Swineford
(A motion picture of modern macadam road building machinery in action)

Soil Aggregate Stabilized Roads—Mr. Scott

Railroad Ballast—Mr. Goldbeck

Stone for Use in Trickling Filters—Mr. Feild

Stone for Use in Concrete Block—Mr. Biggs

The Question of Flat and Elongated Pieces — Mr. Gray

Each "student" was provided with a "kit" in a substantial folder which included a mimeographed set of "Highlights" of the respective talks and also various papers reprinted from *The Crushed Stone Journal*; likewise Simplified Practice Recommendation R163-48 on aggregate size; NCSA Bulletin 11 revised as of January 1949; and several publications of the American Society for Testing Materials including their recent compilation of Standards on Mineral Aggregates, Concrete and Non-Bituminous Highway Materials.

Laboratory Demonstrations

The above program occupied the first three days of the course and on the morning of the fourth day laboratory tests were shown, and in part demonstrated, involving:

Aggregate Tests

Deval Abrasion
Dorry Hardness
Page Impact
Los Angeles Abrasion
Sodium Sulphate—"Before" and "After" Examples
Specific Gravity
Volumetric and Linear Change

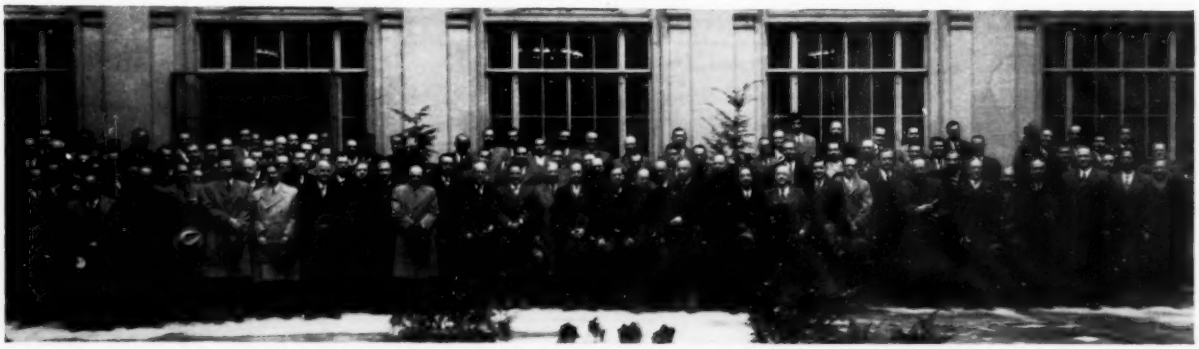
Concrete

Slump and Flow Tests
Compression Tests
Beam Tests
Freezing and Thawing—Expansion Measurements, Dynamic Modulus

Bituminous Concrete

Immersion-Compression Tests for Durability
Circular Track Test for Durability
Stripping Tests for Adhesion of Asphalt

In the laboratory, concrete specimens were made to demonstrate the mixing and molding technique and also beams and cylinders were tested. Likewise immersion-compression tests were made on bitumi-



Among Those Present at Third Short Course for Crushed Stone Salesmen

nous concrete and the molding procedure was demonstrated. Mimeographed Highlights of the Laboratory Tests were distributed and these together with the Highlights of the three days of lectures and the accompanying literature, formed a very substantial reminder of the subjects covered during the entire course.

Get-Together Party

The social side of the school was not neglected and an informal and extremely pleasant "Get-Together Party" was held at the Mayflower Hotel at which many acquaintances were made or renewed. At the end of the first day's session each participant was provided with a mimeographed list of those attending with their Washington addresses so that contacts could be made with little trouble.

There seems to be no doubt whatever about the success of the entire course. Those attending, collectively, in the form of a motion, and individually expressed themselves as being delighted with the entire program; they thought it was well worth their time and travel expense.

List of Those Who Attended

CRUSHED STONE PRODUCERS

Acme Limestone Co.
Charles F. Smith, Fort Spring, W. Va.

Bethlehem Steel Co.
Carl Beckler, Bethlehem, Pa.
H. W. Lynn, Harrisburg, Pa.

Blue Rock Quarry
Norman W. Blethen, Cumberland Mills, Maine
Philip V. Corey, Cumberland Mills, Maine
Charles F. Parker, Cumberland Mills, Maine

Blue Ridge Stone Corp.
J. T. Wingfield, Roanoke, Va.

Buffalo Crushed Stone Corp.
W. A. Cavanaugh, Buffalo, N. Y.
Elmer C. Hourt, Buffalo, N. Y.

Callanan Road Improvement Co.
Prescott D. Archibald, South Bethlehem, N. Y.
R. I. Harris, South Bethlehem, N. Y.
Kenneth R. Van Alstyne, South Bethlehem, N. Y.
Lester A. Van Alstyne, South Bethlehem, N. Y.

Canada Crushed Stone Ltd.
H. F. Coon, Hamilton, Ontario, Canada

Carbon Limestone Co.
Lewis M. Nauss, Lowellville, Ohio

Concrete Materials and Construction Co.
F. E. Bellamy, Cedar Rapids, Iowa
K. K. Kinsey, Cedar Rapids, Iowa
Gene M. Mason, Cedar Rapids, Iowa

Consumers Co.
William B. Ryan, Chicago, Ill.

Cowan Stone Co.
George L. Henley, Cowan, Tenn.

Cumberland Quarries, Inc.
E. D. Kelb, Indianapolis, Ind.

East St. Louis Stone Co.
William E. Hewitt, East St. Louis, Ill.

Franklin Limestone Co.
James A. Black, Nashville, Tenn.
R. F. Goodrich, Nashville, Tenn.
William G. Gray, Nashville, Tenn.
John T. Hicks, Nashville, Tenn.

General Crushed Stone Co.
O. E. Benson, Easton, Pa.
I. H. Boggs, Easton, Pa.
J. Fred Coleman, Jr., Philadelphia, Pa.
E. E. Dotter, Easton, Pa.
Guy W. Faylor, Jordanville, N. Y.
J. W. Harward, Philadelphia, Pa.
John C. Hayes, Utica, N. Y.
C. T. Johnson, Easton, Pa.
Frank P. McCluskey, Jr., Easton, Pa.
Charles A. Reid, Boston, Mass.
John Rice, Jr., Easton, Pa.
J. K. Scott, Rochester, N. Y.
W. R. Smallwood, Syracuse, N. Y.
T. J. Trainor, Boston, Mass.
H. M. Van Cleve, Syracuse, N. Y.
F. G. Zoller, Watertown, N. Y.

Kentucky-Virginia Stone Co.
W. B. Paynter, Jr., Middlesboro, Ky.

Lehigh Stone Co.
Delmore Groff, Kankakee, Ill.
D. S. Pickett, Kankakee, Ill.

LeRoy Lime and Crushed Stone Corp.
John F. Judge, LeRoy, N. Y.

Liberty Limestone Corp.
John R. Rice, Buchanan, Va.

Lynn Sand and Stone Co.
C. H. Latham, Swampscott, Mass.

Massachusetts Broken Stone Co.
Richard Robinson, Weston, Mass.

Material Service Corp.
J. L. Fay, Chicago, Ill.

New Haven Trap Rock Co.
Charles W. Hutton, New Haven, Conn.
Edward T. Perry, Providence, R. I.
Donald E. Reigeluth, New Haven, Conn.
Robert S. Reigeluth, New Haven, Conn.
Robert S. Ross, New Haven, Conn.

New York Trap Rock Corp.
Girard Boyce, New York, N. Y.
Joseph A. Dooley, New York, N. Y.
Melvin G. Dow, New York, N. Y.
George C. Harris, Newburgh, N. Y.
Edward B. Kirby, New York, N. Y.
Robert E. Mead, New York, N. Y.
Carl Stenz, New York, N. Y.

North American Cement Corp.
C. G. Branner, Baltimore, Md.
W. H. Funk, Hagerstown, Md.
John L. Hurley, Washington, D. C.
V. J. Lawler, Baltimore, Md.
John L. Morton, Jr., Washington, D. C.
Frederick S. Schroeder, Baltimore, Md.
E. S. Story, Baltimore, Md.
Ralph N. Heck, Washington, D. C.

North Jersey Quarry Co.
Melvin F. Haas, Morristown, N. J.
Montagu Hankin, Jr., Morristown, N. J.

Old Colony Crushed Stone Co.
Joseph F. Cahill, West Quincy, Mass.
Daniel J. Kelley, Quincy, Mass.

Pittsburgh Limestone Corp.
S. H. Bell, Pittsburgh, Pa.
T. J. Foster, New Castle, Pa.
E. A. Weymouth, Pittsburgh, Pa.

Rowe Contracting Co.
Warren C. Rowe, Boston, Mass.

Schildberg Const. Co.
Dennis Schildberg, Greenfield, Iowa

Servtex Materials Co.
Paul E. Thompson, New Braunfels, Texas

Standard Lime and Stone Co.
Henry T. Boswell, Washington, D. C.
Robert C. Brand, Baltimore, Md.
Shelton R. Clemmer, Arlington, Va.
Edward F. Maisel, Baltimore, Md.
Marshall E. Reid, Baltimore, Md.
W. C. Thompson, Baltimore, Md.

Superior Stone Co.
W. M. Ragland, Red Hill, Va.
W. T. Ragland, Raleigh, N. C.
W. T. Ragland, Jr., Raleigh, N. C.
William G. Ross, Marion, N. C.
L. B. Shuping, Raleigh, N. C.
J. J. Summerell, Raleigh, N. C.
P. A. Wallenborn, Red Hill, Va.
J. W. Yates, Raleigh, N. C.

Wallace Stone Co.
J. E. Ott, Bay Port, Mich.

Weston and Brooker Co.
B. O. Brooker, Columbia, S. C.
J. D. Sands, Columbia, S. C.
Richard Simons, Columbia, S. C.

West Roxbury Crushed Stone Co.
Alfred N. Foley, West Roxbury, Mass.

Zenith Dredge Company
Oliver A. Haskins, W. Duluth, Minn.

GUESTS

District of Columbia Highway Department
Norman G. Smith, Washington, D. C.

Navy, Bureau of Aeronautics
Leslie C. Davies, Washington, D. C.
Joseph B. Sales, Washington, D. C.

New York State Bituminous Concrete Producers Association
Claire A. Downing, Albany, N. Y.

New York State Crushed Stone Association
Harry R. Hayes, Albany, N. Y.

Pennsylvania Stone Producers Association
H. H. Wagner, Harrisburg, Pa.

Public Roads Administration
Russell H. Brink, Washington, D. C.
E. F. Kelley, Washington, D. C.
J. T. Pauls, Washington, D. C.
H. C. Vollmer, Washington, D. C.

Rock Products
Walter B. Lenhart, Chicago, Ill.

George Washington University
Charles A. Appel III, Washington, D. C.

A summary of the list of those who attended shows that there were 100 representatives from 37 companies, 12 speakers, and 12 guests or a total registration of 124. This was a very good attendance and taken into consideration with the very evident satisfaction and even enthusiasm of the company representatives, it seems desirable to continue this form of Association activity at appropriate intervals.

MANUFACTURERS DIVISION

of the

NATIONAL CRUSHED STONE ASSOCIATION

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.
Crushing, Screening, Washing, Grinding, Cement Machinery; Motors; Texrope Drives; Centrifugal Pumps; Tractors

American Cyanamid Co.
Explosives Department
2527 Oliver Bldg., Pittsburgh 22, Pa.
Explosives and Blasting Supplies

American Manganese Steel Division of American Brake Shoe Company
389 East 14th St., Chicago Heights, Ill.
Manganese Steel Castings, Power Shovel Dippers, Material Handling Pumps, Heat and Corrosion Resistant Castings, Reclamation and Hard-Facing Welding Materials

American Pulverizer Co.
1249 Macklind Ave., St. Louis 10, Mo.
Manufacturers of Ring Crushers and Hammermills for Primary and Secondary Crushing

Atlas Powder Co.
Wilmington 99, Del.
Industrial Explosives and Blasting Supplies

Bacon-Greene & Milroy
205 Church St., New Haven 10, Conn.
"FARREL-BACON" Jaw Crushers for Primary and Secondary Operation. Conveyors, Elevators, Rolls, Screens

Bacon-Pietsch Co., Inc.
149 Broadway, New York 6, N. Y.
Manufacturers of Farrel-Bacon Crushers and allied Screening & Conveying Equipment

Barber-Greene Co.
Aurora, Illinois
Portable and Permanent Belt Conveyors, Belt Conveyor, Idlers, Bucket Loaders both Wheel and Crawler Mounted, Asphalt Mixers and Finishers, Coal Handling Machines

C. G. Buchanan Crushing Machinery Division of the Birdsboro Steel Foundry and Machine Co.
1941 Furnace St., Birdsboro, Pa.
Primary, Secondary and Finishing Crushers and Rolls

Bucyrus-Erie Co.
South Milwaukee, Wis.
Excavating, Drilling and Material Handling Equipment

Cross Engineering Co.
Carbondale, Pa.
Screen Plates and Sections, Perforated Plate, for Vibrating, Rotary and Shaking Screens

Cummins Engine Co., Inc.
Columbus, Ind.
Diesel Engines, Fuel Pumps

Deister Machine Co.
1933 East Wayne St., Fort Wayne 4, Ind.
Deister Plat-O Vibrating Screen, Deister Compound Funnel Classifier

Detroit Diesel Engine Division General Motors Corp.
13400 West Outer Drive, Detroit 23, Mich.
Light Weight, Compact 2 Cycle Diesel Engines and "Package Power" Units for All Classes of Service

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Del.
Explosives and Blasting Accessories

Easton Car and Construction Co.
Easton, Pa.
Heavy-Duty Dump Body Trailers for Rock and Ore, Truck Bodies and Quarry Cars. Overhead Hoists for Dumping Haulage Units. Electric Heaters for Tar, Asphalt or Bitumen.

Ensign-Bickford Co.
Simsbury, Conn.
Cordeau-Bickford Detonating Fuse and Safety Fuse

MANUFACTURERS DIVISION of the NATIONAL CRUSHED STONE ASSOCIATION

Euclid Road Machinery Co.
1361 Chardon Road, Cleveland 17, Ohio
Heavy-Duty Trucks and Dump Trailers for "Off Highway" Hauls, Loaders for Earth Excavation

Frog, Switch & Mfg. Co.
Carlisle, Pa.
Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches and Crossings, Jaw and Gyratory Crushers, Cement Mill, Mining Machinery, etc., Steam Shovel Parts

General Electric Co.
1 River Road, Schenectady 5, N. Y.
Electric Motors

Gill Rock Drill Co.
Lebanon, Pa.
Well Drill Tools and Supplies

Goodyear Tire & Rubber Co., Inc.
Akron, Ohio
Belting (Conveyor, Elevator, Transmission), Hose (Air, Water. Steam, Suction, Miscellaneous), Chute Lining (Rubber)

Gruendler Crusher and Pulverizer Co.
2915 N. Market St., St. Louis 6, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammer Mills, Lime Pulverizers

George Haiss Mfg. Co., Inc., Division of Pettibone Mulliken Corp.
141st-144th on Park Ave., New York 51, N. Y.
Bucket Loaders, Buckets, Portable and Stationary Conveyors, Car Unloaders

Harnischfeger Corp.
4400 W. National Ave., Milwaukee 14, Wis.
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators

HarriSteel Products Co.
420 Lexington Ave., New York 17, N. Y.
Woven Wire Screen Cloth

Hayward Co.
50 Church Street, New York 7, N. Y.
Orange Peel Buckets, Clam Shell Buckets, Electric Motor Buckets, Automatic Take-up Reels

E. Lee Heidenreich, Jr., Consulting Engineers
67 Second St., Newburgh, N. Y.
Plant Layout, Design, Supervision; Open Pit Quarry Surveys; Appraisals—Plant and Property

Hendrick Mfg. Co.
Carbondale, Pa.
Perforated Metal Screens, Perforated Plates for Vibrating, Shaking and Revolving Screens; Elevator Buckets; Hendrick Vibrating Screens

Hercules Powder Co.
Wilmington 99, Del.
Explosives and Blasting Supplies

Hetherington & Berner Inc.
701-745 Kentucky Ave., Indianapolis 7, Ind.
Asphalt Paving Machinery, Sand and Stone Dryers, Dust Collectors

Highway Equipment Co., Inc.
616 D Ave., N.W., Cedar Rapids, Iowa
Complete Line of Spreaders

Illinois Powder Mfg. Co.
112 N. 4th St., St. Louis 2, Mo.
Gold Medal Explosives

Ingersoll-Rand Co.
11 Broadway, New York 4, N. Y.
Rock Drills, Quarrymaster Drill, Jackbits, Bit Reconditioning Equipment, Portable and Stationery Air Compressors, Air Hoists, Slusher Hoists, Air Tools, Diesel Engines, Pumps

Insley Manufacturing Corp.
801 N. Olney St., Indianapolis 6, Ind.
Concrete Carts and Buckets, ½ Yd. Cranes and Shovels

Iowa Manufacturing Co.
Cedar Rapids, Iowa
Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Hot and Cold Mix Asphalt Plants, Stabilizer Plants, KU-BIT Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment, Hammermills

Jeffrey Manufacturing Co.
E. First Ave., Columbus 16, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

Joy Manufacturing Co.
333 Oliver Bldg., Pittsburgh 22, Pa.
Drills: Blast-Hole, Wagon, Rock, and Core; Air Compressors: Portable, Stationary and Semi-Portable; Aftercoolers; Portable Blowers; Carpullers; Hoists: Multi-Purpose and Portable; Rock Loaders; Air Motors; Trench Diggers; Belt Conveyors; Drill-Bit Furnaces; "Spaders"; "String-a-Lite" (Safety-Lighting-Cable); Backfill Tampers; Drill Bits: Rock and Core

MANUFACTURERS DIVISION of the NATIONAL CRUSHED STONE ASSOCIATION

Kennedy-Van Saun Mfg. and Eng. Corp.
2 Park Ave., New York 16, N. Y.
Material Handling Machinery—Crushers, Pulverizers, Vibrating Screens

Kensington Steel Co.
505 Kensington Ave., Chicago 28, Ill.
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

Keystone Driller Co.
Beaver Falls, Pa.
Drills, Power Shovels

King Powder Co., Inc.
Cincinnati, Ohio
Detonite, Dynamites, and Blasting Supplies

Koehring Co.
3026 W. Concordia Ave., Milwaukee 10, Wis.
Mixers, Pavers, Shovels, Cranes, Draglines, Dumptors, Traildumps, Mud-Jacks

Kraft Bag Corp.
630 Fifth Ave., New York 20, N. Y.
Heavy Duty Multiwall Paper Bags

Lima Shovel and Crane Division Lima-Hamilton Corp.
Lima, Ohio
Power Shovels, Draglines and Cranes

Link-Belt Co.
300 West Pershing Road, Chicago 9, Ill.
Complete Stone Preparation Plants. Conveyors, Elevators, Screens, Washing Equipment, Speed-o-Matic Shovels—Cranes—Draglines and Power Transmission Equipment

Ludlow-Saylor Wire Co.
Newstead Ave. & Wabash R. R.
St. Louis 10, Mo.
Woven Wire Screens and Wire Cloth of Super-Loy, Magna-Loy and All Commercial Alloys and Metals

Mack Manufacturing Corp.
350 Fifth Ave., New York 1, N. Y.
On- and Off-Highway Trucks, Tractor Trailers, Six-Wheelers, from 5 to 30 Tons Capacity, both Gasoline- and Diesel-Powered

Marion Power Shovel Co.
Marion, Ohio
A Complete Line of Power Shovels, Draglines and Cranes

McLanahan & Stone Corp.
200 Wall St., Hollidaysburg, Pa.
Complete Pit, Mine and Quarry Equipment —Crushers, Washers, Screens, Feeders, etc.

Murphy Diesel Co.
5317 W. Burnham, Milwaukee, Wis.
Murphy Diesel Engines Ranging from 90 to 165 Continuous Horsepower at 1200 Rpm. and Packaged Type Generator Sets 60 Kw. to 106 Kw. for All Classes of Service

New Holland Machine Co.
New Holland, Pa.
Limestone Pulverizers; Jaw, Roll, and Hammer Crushers; Elevators; Revolving and Vibrating Screens; Dewaterers; Belt and Apron Conveyors; Conveyor Belting; V-Belts; V-Belt Drives; Engines; Electric Motors; Concrete Mixers With or Without Power Lifts

Noble Co.
1860 7th St., Oakland 7, Calif.
Batching Plants, Bulk Cement Plants

Nordberg Mfg. Co.
307 S. Chase Ave., Milwaukee 7, Wis.
Cone, Gyratory, Jaw and Impact Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens; Grizzlies; Diesel and Steam Engines; Compressors; Mine Hoists; Track Maintenance Tools

Northern Blower Co.
W. 65th St., South of Denison
Cleveland 2, Ohio
Dust Collecting Systems, Fans—Exhaust and Blowers

Northwest Engineering Co.
135 S. LaSalle St., Chicago 3, Ill.
Shovels, Cranes, Draglines, Pullshovels

Pennsylvania Crusher Co.
Liberty Trust Bldg., Philadelphia 7, Pa.
Complete Line of Crushing Equipment

Pioneer Engineering Works, Inc.
1515 Central Ave., Minneapolis 13, Minn.
Jaw and Roll Crushers, Vibrating and Revolving Screens, Scrubbers, Belt Conveyors, Traveling Grizzley Feeder

Pit and Quarry Publications
538 South Clark St., Chicago 5, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Concrete Manufacturer, Concrete Industries Yearbook

Quaker Rubber Corp.
Tacony and Milnor Sts., Philadelphia 24, Pa.
Conveyor Belts, Hose and Packings

Robins Conveyors Division, Hewitt-Robins Incorporated
370 Lexington Ave., New York 17, N. Y.
Belt Conveyors, Bucket Elevators, Gyrex and Vibrex Screens, Feeders, Design and Construction of Complete Plants

MANUFACTURERS DIVISION of the

NATIONAL CRUSHED STONE ASSOCIATION

Rock Bit Sales and Service Co.
350 Depot St., Asheville, N. C.
Tungsten Carbide Detachable Bits, "Rock Bit" Drill Steel Inlaid with Tungsten Carbide, Carbon Hollow Drill Steel, Alloy Hollow Drill Steel

Rock Products
309 West Jackson Blvd., Chicago 6, Ill.

John A. Roebling's Sons Co.
640 S. Broad St., Trenton 2, N. J.
Aggregate Screen, Hardware and Industrial Wire Cloth, Insect Screening, Wire Rope, Fittings and Strand, Slings, Suspension Bridges and Cables, Aerial Wire Rope Systems, Ski Lifts, Electrical Wire and Cable, Magnet Wire

Sanderson-Cyclone Drill Co.
South Main St., Orrville, Ohio
All Steel Wire Line, Air Speed Spudder, Large Blast Hole Drills, Drilling Tools and Drilling Supplies

Screen Equipment Co.
9 Lafayette Ave., Buffalo 13, N. Y.
SECO Vibrating Screens

Simplicity Engineering Co.
Durand, Mich.
Simplicity Gyrating Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

Smith Engineering Works
E. Capitol Drive at N. Holton Ave., Milwaukee 12, Wis.
Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

St. Regis Sales Corp.
1925 O'Sullivan Bldg., Baltimore 2, Md.
Main Office: 230 Park Ave., New York 17, N. Y.
Automatic Filling and Weighing Machines and Multiwall Paper Shipping Sacks

Stedman's Foundry & Machine Works
Aurora, Ind.
Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Limestone Pulverizers

Stephens-Adamson Mfg. Co.
Aurora, Ill.
Belt Conveyors, Elevators, Feeders, Car Pullers, Screens, Skip Hoists, Complete Plants

Taggart Corp.
(See St. Regis Sales Corp.)

W. O. & M. W. Talcott, Inc.
91 Sabin St., Providence, R. I.
Belt Fasteners, Belt Lacing, Conveyor Belt Fasteners, and Patch Fasteners

Taylor-Wharton Iron & Steel Co.
High Bridge, N. J.
Manganese and other Special Alloy Steel Castings

Thew Shovel Co.
Lorain, Ohio
Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes. Draglines. Diesel Electric, Gasoline. 3/8 to 2-1/2 Cu. Yd. Capacities

Traylor Engineering & Mfg. Co.
Allentown, Pa.
Stone Crushing, Gravel, Lime and Cement Machinery

Trojan Powder Co.
17 N. 7th St., Allentown, Pa.
Explosives and Blasting Supplies

W. S. Tyler Co.
3615 Superior Ave., N.E., Cleveland 14, Ohio
Wire Screens, Screening Machinery, Scrubbers, Testing Sieves and Dryers

Unit Crane and Shovel Corp.
6411 W. Burnham St., Milwaukee 14, Wis.
Power Cranes and Shovels: Unit 514, ½ Yd. Crawler; Unit 1020, ¾ Yd. Crawler and Truck Mounted; Unit 357, ½ Yd. Self-Propelled Mobile Crane; Unit 1014, ½ Yd. Truck Mounted; Unit 1520, ¾ Yd. Self-Propelled Mobile; Every UNIT Model Completely Convertible to All Attachments

Universal Engineering Corp.
625 C Ave., N.W., Cedar Rapids, Iowa.
Jaw Crushers, Roll Crushers, Hammermills, Complete Crushing, Screening and Loading Plants, Either Stationary or Portable for Stone Aggregates or Aglime

Vibration Measurement Engineers
7705 Sheridan Rd., Chicago 26, Ill.
Specialists in Blasting Complaint Investigations; Seismological Surveying; Expert Testimony in Blasting Litigation

Technical Publications
of the
National Crushed Stone Association

STONE BRIEFS

No. 1. How to Proportion Workable Concrete for Any Desired Compressive Strength

No. 2. How to Proportion Concrete for Pavements

No. 3. Uses for Stone Screenings

No. 4. How to Determine the Required Thickness of the Non-Rigid Type of Pavement for Highways and Airport Runways

ENGINEERING BULLETINS

No. 1. The Bulking of Sand and Its Effect on Concrete

No. 2. Low Cost Improvement of Earth Roads with Crushed Stone

No. 3. The Water-Ratio Specification for Concrete and Its Limitations
(Supply Exhausted)

No. 4. "Retreading" Our Highways

No. 5. Reprint of "Comparative Tests of Crushed Stone and Gravel Concrete in New Jersey" with Discussion

No. 6. The Bituminous Macadam Pavement

No. 7. Investigations in the Proportioning of Concrete for Highways

No. 8. The Effect of Transportation Methods and Costs on the Crushed Stone, Sand and Gravel, and Slag Industries
(Supply Exhausted)

No. 9. Tests for the Traffic Durability of Bituminous Pavements

No. 10. Stone Sand

No. 11. A Method of Proportioning Concrete for Strength, Workability, and Durability. (Revised January, 1949)

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Single copies of the above publications are available upon request.

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Manual of Uniform Cost Accounting Principles and Procedure for the Crushed Stone Industry *($2.00 per copy)*